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“It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.”

SIR WM. JONES.

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1871.

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JOURNAL OF THE ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. I.—1871.

DESCRIPTIONS OF NEW MOLLUSCA FROM THE EASTERN REGIONS,—*by*
MESSRS. G. AND H. NEVILL.

[Received and read 7th September, 1870.]

(With Plate I).

We have already had the honor of laying before the Society two papers, containing descriptions of new Mollusca from these seas; the present one contains descriptions of 12 new species of marine shells from Ceylon, Mauritius and Pooree (Bay of Bengal), for the several very interesting species from the latter locality, we are greatly indebted to H. C. Raban, Esq., C. S., who has lately been successful in obtaining some more shells, of almost equal interest, from Chittagong. We had also described, and prepared a drawing, of a very interesting new species of *Leptoco-*
chus, but fortunately noticed, just in time, its description by Liénard in the number of the French Journal de Conchiliologie which we had just received; as, however, no figure was given, we have thought it desirable to take this opportunity of doing so; we have also named and described an interesting new species of *Cataulus* from Ceylon, the smallest as yet known, a new species of *Pisidium* from India and 5 new land shells from Mauritius and the Seychelles. We have also given two figures of an interesting species of *Cypricardia*, *C. spathulata*, described by Souverbie in the Jour-

nal de Conchiliologie for 1862, p. 232. Finally we have figured, and made a few further notes on two new species lately described by us in the Ceylon Asiatic Society's Proceedings.

Glaucanella Andersoni, *n. sp.*, Pl. I. Fig. 13, 13a, 13b.

T. ovalis, glauca, aperta, indistincte longitudinaliter striata; spira paululum involuta; labio appendiculo minimo munito; aperturâ ampla, antice dilatata, margine antico ovaliter arcuato, postico sub-coarctato. Long. $8\frac{1}{2}$, Diam. maj. $6\frac{1}{2}$, Alt. $3\frac{1}{2}$ m.m.

This interesting species in shape closely resembles *G. viridis*, Rang., the body of the shell is, however, considerably more involute and the colour a pale apple green; it also differs from the above, as well as from all the other described species of the genus, in the small, almost rudimentary, appendage. It is tolerably abundant on reefs at low water in the S. Province, Ceylon. Dr. Stoliczka also found it at Penang. The animal is dull greenish, mottled with brown, the eyes are sessile, very small and black; the shell is completely hidden by the meeting of the lateral expansions of the mantle, in this respect differing from *G. viridis*, in which, according to A. Adams, the shell is only partially hidden. Its mode of progression, at the time, strongly reminded one of us of that of *Omphalotropis*.

Cylichna lactuca, *n. sp.*, Pl. I. Fig. 2, 2a.

T. anguste cylindrica, solida, lævis, nitida, alba; anfractibus tribus, ad suturam canaliculatis; spirâ brevissima, paululum exserta, nucleo mammillato, ultimo anfractu ad medium paulo constricto, aperturâ supra angusta, lineari, ad suturam incisa, infra modice dilatata ac sub-rotundata; labro acuto, ad medium paululum producto, labio levissime convexiusculo, paulo incrassato; columellâ plicâ unica, valida, per-obliqua instructa. Long. $8\frac{1}{2}$, Diam. $4\frac{1}{2}$ m.m. S. Province, Ceylon.

This milky-white little shell appears to be nearest allied to *Cylichna voluta*, Quoy. It also closely resembles the following, the body whorl, however, is a little more contracted in the centre, and instead of descending somewhat rapidly, it completely folds round the upper whorls; the apex is distinctly mammillated and the outer lip is not so contracted anteriorly. It also seems to be much rarer.

Cylichna involuta, *n. sp.*, Pl. I. Fig. 3, 3a.

T. cylindrica, solida, alba, lævis, nitida; anfractibus tribus, suturâ sub-canaliculata junctis, spirâ sub-conica, exserta, apice sub-mammillato; labro fere recto, tenui, labio crassiusculo, infra incurvo; columellâ uniplicata. Long $8\frac{1}{2}$, Diam. $3\frac{1}{2}$ m. m.

S. Province, Ceylon.—Bombay and Penang (Dr. F. Stol.).

Ringicula apicata, *n. sp.*, Pl. I. Fig. 10, 10a.

T. minuta, elongato-turrita, solidiuscula, lævis; spirâ acutissima, suturâ perdistincta; anfractibus quinis, ultimo maximo, oblongo ac ventricoso, labio truncato, medio unidentato; columellâ duabus plicis validis munita; labro incrassato, medio interne sub-denticulato, ad basin sub-truncato. Long $2\frac{1}{2}$, Diam. $1\frac{1}{3}$ m. m.

Very rare, Pt. Louis Harbour, Mauritius.

Gibbula Holdsworthana, *n. sp.*, Pl. I. Fig. 18.

T. parva, turbinata, tenuis, cornea, sparsim irregulariter viride marmorata, ad basin dense nigro-viride punctata; anfractibus quinis, angulatis, ad suturam oblique deplanatis, indistincter biplicatis, superioribus infra carinis duabus, acutis, validis, ultimo tribus instructis; basi sub-applanata, tribus carinis sub-granulosis instructa, una valida ad marginem umbilici sita; umbilico intus spiraliter costulato; aperturâ fere circulari, labro simplici, interne distincter margaritaceo. Alt. $4\frac{1}{2}$, Diam. $3\frac{4}{5}$ m.m.

Rare; S. Province, Ceylon.

This is another small shell belonging to the same group, as the one described by us in the Society's Journal for 1869, p. 159, under the name of *G. sub-plicata*, in the present species the sculpture is more regular and the colouring more vivid, being slightly flamed with a very dark green, principally on the whorls near the apex; also closely dotted with the same on its base; the umbilicus is wider &c. The generic characters would seem to indicate an intermediate position between *Gibbula* and *Margarita*.

ROBINSONIA, nobis.

Ceylon Asiat. Soc. Proc. May, 1869.

The shells of this genus are of a *Naticoid* appearance, of a thin, delicate texture, composed of a few rapidly increasing whorls,

not umbilicated, with a simple columella, the outer lip of the aperture is not reflexed; they somewhat resemble *Amauropsis*. The genus was named after Sir Hercules Robinson, Governor of Ceylon.

R. CEYLONICA, nobis, (loc. cit.), Pl. I. Fig. 5.

This shell, from Matura in Ceylon, forms the type of the above genus, it is of globose, inflated growth, composed of four whorls, almost smooth, of a whitish colour, encircled with a very broad, chocolate belt; it would seem to be very rare. Long. 11, Diam. 10, Alt. apert. $8\frac{1}{2}$, Diam. apert. 7 m.m.

R. PUSILLA, nobis, (loc. cit.) Pl. I, Fig. 6.

This delicate little shell, from Balapitiya in Ceylon, is not nearly so inflated as the preceding, its form being oval instead of ventricose, composed of five whorls, the spire more acute and the suture more distinct; it is of a milky white colour with a brown apex, marked on the last whorl with two, somewhat indistinct, narrow brown stripes; it resembles *R. Ceylonica* in being almost smooth, only slightly marked with the lines of growth.

Long. 6, Diam. 4, Alt. apert. $3\frac{1}{2}$, Diam. apert. $2\frac{1}{2}$ m.m.

Fossarus Stoliczkanus, *n. sp.*, Pl. I. Fig. 10, 10a.

T. parva, alba, oviforme-oblonga, sub-crassa; spirâ sub-obtusa, anfractibus tribus, multi-carinatis, interstiis striis incrementi minutissimis decussatis; anfractu ultimo peramplo, obliquo, ample et profunde umbilicato, umbilico intus ruguloso; aperturâ semicirculari, labro ad marginem crenulato, uniforme curvato, intus sulcato, labio crassiusculo, recto, lævi. Long. $4\frac{3}{4}$, Diam. $3\frac{1}{2}$, Alt. apert. $3\frac{1}{2}$, Diam. apert. $1\frac{3}{4}$ m.m.

Rare, S. Province, Ceylon,—Bombay (Dr. F. Stol.)

Fossarus insignis, *n. sp.*, Pl. I. Fig. 9, 9a.

T. tenuis, alba, sub-turbinata; spirâ per-exserta, apice acutissima, suturâ sub-canaliculata; anfractibus 7, convexiusculis, confertim carinatis, carinis spinulose aut granulose rugosis; ultimo anfractu ventricosus, ad aperturam semilunarem dissoluto, profunde ac

anguste umbilicato; labro acuto, crenulato seu minute fimbriato; labio tenui, lævi, paululum curvato.

Long. $6\frac{1}{4}$, Diam. 5, Alt. apert. 4, Diam. apert. $2\frac{1}{2}$ m.m.

Rare; S. Province, Ceylon.

Syrnola dubiosa, *n. sp.*, Pl. I, Fig. 19,

T. parva, angusta, subulata, lævis, vix perforata; anfractibus 10, planis, suturâ distincta, paulo impressa, simplici junctis; aperturâ parva, subovata, postice acute angulata, antice latiuscule sub-rotundata; columellâ paululum reflexa, obliqua, tenui, uniplicata.

Long. 7, Diam. 2 m.m.

This small species closely resembles *S. attenuata*, A. Ad., but can be distinguished by its only having ten whorls, by its slightly less acuminate form, by the absence of any transverse striation and by the unusually indistinct plait on the columella. The aperture is contracted posteriorly and rounded at the base.

Sands at Pooree, Bay of Bengal, (Raban).

Niso pyramidelloides, *n. sp.*, Pl. I. Fig. 14.

T. angusta, subulate acuminata, nitens, lævis; anfractibus quatuordecimis, planulatis, anfractu ultimo ad basin sub-angulato; suturâ sub-indistincta; anfractibus fasciâ castanea ad suturam inferiorem cinctis, ultimis quinque supra medium fascia simili notata; aperturâ compresse sub-rhomboidea, antice et postice angulata, marginibus tenuibus.

Long. 11, Diam. 3. Alt. apert. $2\frac{1}{2}$, Diam. apert. $1\frac{1}{2}$ m.m.

This species cannot be confounded with any other of the genus in form, as also in the manner in which the whorls are belted; it bears considerable analogy to one or two known *Pyramidellæ*, such as *P. pulchella*, Ad. &c. The second brown belt, showing only on the last five whorls, is a remarkable characteristic; it is also the narrowest and most contracted species of the genus yet described.

Sands at Pooree, Bay of Bengal, (Raban); Malacca and Penang, dredged in 3 fathoms on sandy ground (Dr. Stol.)

LEPTOCONCHUS ROBILLARDI, Lién. Pl. I. Fig. 1.

Journ. de Conch. 1870, XV. p. 305.

This handsome and peculiar species reminds one, somewhat, of

certain species of *Coralliophila*; the shell is most remarkably produced at the base into a long, pointed canal, with a deep furrow reaching from its extremity to the narrow umbilicus, the upper whorls are perfectly flat and hidden by a callosity, the body is somewhat flattened and dilated, roughly and handsomely cancellated, with the interstices more or less fimbriated.

Long. 21, Diam. $13\frac{1}{2}$, Alt. apert. $18\frac{1}{2}$, (extra canalem $12\frac{1}{2}$), Diam. apert. $8\frac{1}{2}$ m.m. Mauritius.

***Mangelia bicinctula*, n. sp., Pl. I. Fig. 15, 15a.**

T. turrito-fusiformis, solidula, nitida, fusco-albida, supra et infra indistincter griseo-fulve cincta; anfractibus 6, ad suturam anguste constrictis, sub-cylindricis, ultimo basi attenuato, distincter castaneo tincto, canali recto, brevi, latiuscule desinente, anf. omninis costulis crassiusculis transversis, rectis, et striis spiralibus tenuibus et confertis ornatis; aperturâ angusta, postice angulata; labro externe valde incrassato, albo, postice vix emarginato, intus indistincter crenulato, labio tenuissimo, haud distincter designato, antice paululum ruguloso.

Long. 13, Diam. $4\frac{1}{2}$, Long. anfract. ult. $8\frac{1}{2}$, Alt. apert. $6\frac{1}{2}$, Diam. apert. 2 m. m.

S. Province, Ceylon.

***Helix Newtoni*, n. sp.**

This small species is composed of 6 flattened whorls, much compressed, bearing above considerable resemblance to our common English *H. rotundata*; suture very distinct, somewhat excavated; aperture small, nearly as high as broad, somewhat angular; margin of the lip simple; deeply umbilicated, reminding one a little of certain species of the genus *Solarium*, increased by its most striking characteristic, a row of crenulated, fold-like, closely approximated striæ, which surround the umbilicus and extend over about two-thirds of the base. Very rare, Pouce Mt. Mauritius.

***Helix (Discus) LeVieuxi*, n. sp.**

This beautiful little species, which is named after Mr. Le Vieux of Mauritius, possessor of an extremely fine collection of shells

from these seas, is composed of 8 closely wound whorls, moderately elevated and turrited, covered at regular intervals with very strongly developed transverse ribs which fade away towards the obtuse apex, these give it a most interesting appearance under the lens, they are continued on the base of the last whorl, where they almost completely disappear towards the centre, but appear again round the umbilicus; the aperture is very small, the last whorl angular. Alt. $3\frac{1}{2}$, Diam. 2 m.m.

Rare; Mahé, (Seychelles).

Helix (Conulus) sub-turritula, n. sp.

This small, horn-colored shell is composed of 7 turrited, rapidly elevated whorls, divided by a distinct suture, no sculpture is discernible, even under the lens; apex somewhat mammillated; last whorl strongly keeled, its base nearly flat, imperforate; aperture angular, about as high as broad. It can be distinguished from the Indian species of the same type, by its flatter base and less convex whorls. The animal is black mottled with yellow; it was found in a damp ravine at Mahé (Seychelles), at about 800 ft. above the sea. Alt. 4, Diam. $4\frac{1}{2}$ m.m.

Gibbulina Adamsiana, n. sp., Pl. I. Fig. 17.

Testa cylindrico-fusiformis, alba, vix rimata, teniola, sub-flexuose costulata, costulis fere rectis ac validis; anfractibus 8, cylindricis, planatis, gradatim accrescentibus, ultimo regulari; spirâ obtusa, suturâ impressa; aperturâ sub-angulatim quadrata, dente parietali parvo munita, labro reflexo, curvato, labio columellari recto. Long. 18, Diam. max. 6, Alt. apert. 5, Diam. apert. $4\frac{1}{2}$ m.m.

Very rare, near Curepipe, Mauritius.

This very distinct, though rare, species most resembles the remarkable *G. Nevilli*, H. Ad. and *G. Dupontiana*, (Journal, Asiatic Society, Vol. xxxix, page 411); it is easily distinguished from both by the difference in form and sculpture, from the former, also, by only having 8 whorls, from the latter by the almost entirely concealed, instead of very open, umbilicus.

Cataulus Nietneri, n. sp., Pl. I. Fig. 7, 7a.

T. parva, sub-fusiformis, vix perforata, apice sub-obtusa; supra pallide-straminea, infra virescente grisea, et irregulariter albido

strigata; anfractibus 6, convexiusculis, primis duobus vel tribus lævigatis, ceteris transversim costulato striatis, ultimo antice sub-applanato, ad basin acute carinato; aperturâ circulari, peristomate albedo, incrassato ac reflexo, intus ad basin anguste canaliculato. Operculum normale.

Long 11, Diam. $4\frac{1}{4}$, Alt. apert. 4, Diam. apert. $3\frac{1}{2}$ m. m.

This is the smallest species of the genus as yet described, it is also composed of fewer whorls, the last being peculiarly somewhat flattened; the sculpture is obsolete on the first three, just discernible on the fourth and very distinct on the last two whorls; the notch at the base of the peristome is less conspicuous than in the other species of the genus; the shell is of a straw colour, irregularly marbled and streaked with greenish zigzag markings; the operculum is of a light horny texture composed of about 6 whorls. We have named this interesting new *Cataulus* after Mr. Nietner of Ceylon, who has so largely contributed to the knowledge of the Insects of that island.

***Helicina Theobaldiana*, n. sp., Pl. I. Fig. 8, 8a.**

T. parva, depresso-conica, fulvo vel luteo rufescens, sub-obsolete striata; anfractibus quinis, supra convexiusculis, ultimo ad peripheriam acute carinato, basi tumido ac lævigato; carinâ luteola; aperturâ semilunari, paulo obliqua, labro reflexiusculo, paulo dilatato ad peripheriam sub-angulato; labio calloso, albedo; columellâ brevissima. Operculum tenue, minute et confertim granulatum, pallide glaucum, margine paululum fusce-rubro tinctum. Alt. $4\frac{1}{2}$, Diam. maj. $4\frac{1}{2}$, D. min. 4 m. m.

This small species has no peculiar characteristics, it varies from a dark rufous brown to a pale straw colour; out of some hundred specimens procured, not a single one had the whorls banded. In height it is tolerably constant, 4- $4\frac{1}{2}$ m. m., but it varies considerably in the breadth, one variety being about $7\frac{1}{2}$, another 6 and a third (the rarest of all) as high as broad; it somewhat resembles a species from Tonghoo (? *crocina* Bens. apud Theobald), it can be distinguished by the smoother surface, by the absence of stripes, by the tumidity of the base, and by the greater development of the callosity. It also is very close to *II. Nicobarica*, Phil.

from the Nicobars, indeed so much so, that some specimens are barely distinguishable, the minute spiral sculpture of the latter being almost the only constant difference. Abundant at the Seychelles, on the ground amongst decaying leaves, &c.

Nucula Rabaniana, *n. sp.*, Pl. I. Fig. 11, 11*a*, 11*b*, 11*c*.

T. parvula, perobliqua, valde inæquilateris, crassa, moderate inflata, nitida, pallidula, radiatim obsolete confertim lineolata et concentrice striata, striis distantibus, sub-obsolete; parte antica valde et angustatim producta, postica brevi et abrupte truncata; margine supero, aut dorsali, utriusque valvæ eleganter et crasse granulato; margine interno valvarum minute crenulato; cardo dentibus validis antice 23, postice 7, instructus, foveâ ligamentali angustissima separatis. Length 6, breadth $4\frac{1}{2}$, thickness 3 m.m.

In shape somewhat resembling *N. Paytensis*, A. Ad., (var. of *N. crenulata*, A. Ad., apud Hanley), the posterior extremity a trifle more produced, the sculpture is, however, very different.

The concentric grooves in the present species are very indistinct, often becoming altogether obsolete, there are only traces of radiating striation; the striking feature, however, is the two peculiar rows of oblique granules (nine in each row) on the anterior dorsal margins; the inner margins are unusually strongly crenulated; the teeth very long and sharp, especially the seven posterior ones.

Pooree, Bay of Bengal, (Raban). Dr. Stoliczka dredged near Penang in 4 fathoms a few specimens of what appears to be this species. They are a little more elongated than those from Pooree.

Pisidium Clarkeanum, *n. sp.*, Pl. I. Fig. 4, 4*a*, 4*d*.

T. ventricosa, oblonga, valide inæquilateris, pallide fulva; postice elongata ac rotundata, antice rotundate truncata; umbonibus prominentibus ac tumidis; superficie concentrice confertim striata, striis tenuibus, regularibus.

Length $5\frac{1}{2}$, breadth from the umbones $4\frac{1}{2}$, thickness $8\frac{1}{2}$ m.m.

I am indebted for this species to my friend Mr. G. R. Clarke; it is tolerably abundant in tanks &c., close to the Damuda at Moirak. I have lately received a very similar shell from Chittagong, only differing by its smaller size, less produced posterior end and less tumid umbones; it may prove to be specifically distinct. I have

also a third closely allied species before me from the neighbourhood of Bombay, this differs, however, materially from the two former by its more produced and sub-angulate anterior end and by the more central position of the umbones &c., it is smaller than either of the preceding forms. A fourth Indian species in my collection from the Himalayas is very distinct from any of the above, it will probably prove to be *P. paludosum*, Hutt. (Journ. As. Soc. Bengal, xviii, p. 649).

Cryptogramma Arakana, *n. sp.*, Pl. I. Fig. 16, 16a.

T. oblonga, subventricosa, alba, maculis castaneis pervariabile sparsim flammulata ; lunulâ angusta, attenuata, parte anteriore fusca ; umbonibus prominentibus, paululum antice positis ; latere postico angustato, oblique truncato, ad extremitatem rotundate obtuso, antico rotundato ; superficie valvarum costulis concentricis et radiantibus ornata, primis in parte media, alteris antice et postice multo fortioribus et squamulosis.

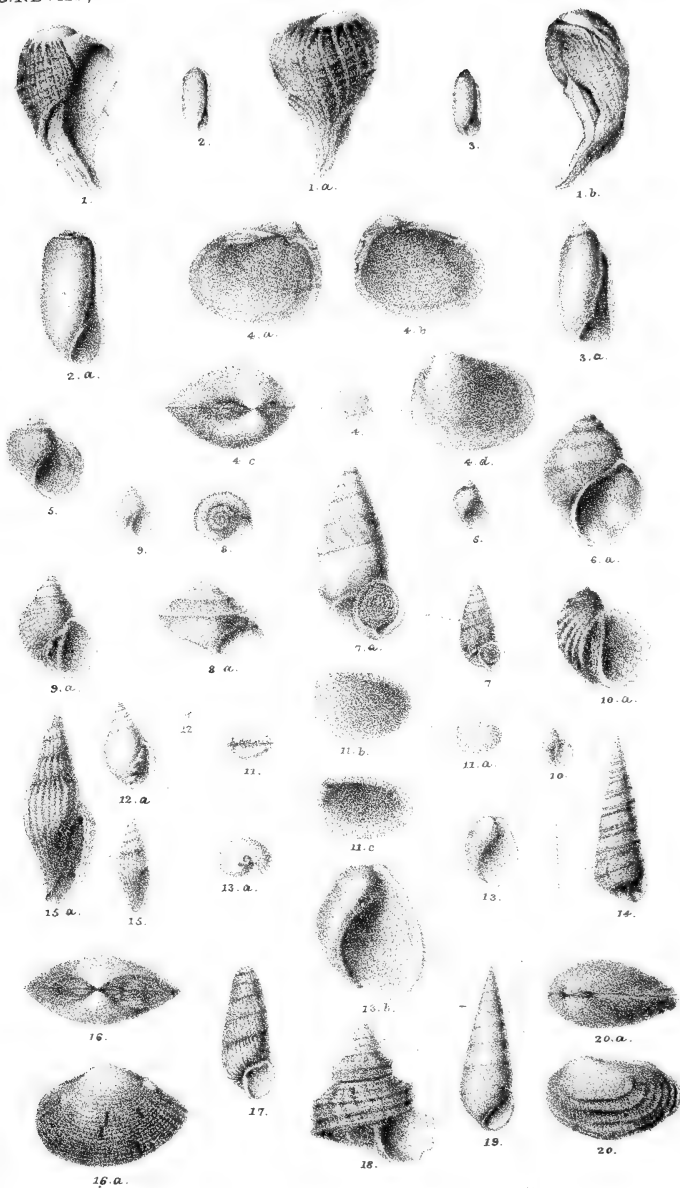
Length 14, breadth from the umbones $13\frac{1}{2}$, thickness 9 m.m.

Dredged alive by Mr. H. F. Blanford in Arakan, to whom we are indebted for specimens ; single valves are abundant on the sands in the S. Province, Ceylon ; it was also found by Dr. Stoliczka at Penang and Singapore, being extremely common at both localities. The sculpture of this handsome little shell is very peculiar, in the centre it is strongly latticed with close set ribs, which form, where they cross one another, large, nearly round granules ; at the extreme anterior side, there are no decussating ribs, but the transverse ones are continued by 4 or 5 rows of broken up, rugose granules ; the posterior side, beginning at about one-third of the breadth of the shell, has somewhat similar rows of granules, somewhat distant, the granules themselves being, for the first 7 or 8 rows, erect and foliaceous, almost spoon-shaped.

CYPRICARDIA SPATHULATA, Souv. Pl. 1, Fig. 20.

Jour. de Conch. pl. ix, f. 2.

A specimen of this interesting species was found by Dr. J. Anderson at the Andamans, and presented by him to the Indian Museum at Calcutta ; it was buried in a slate-colored rock in



For explanation of figures see p. II.

company with a species of *Pholas*; there appears to be no specific difference from the shell figured from New Caledonia by Mr. Souverbie from a unique specimen; my specimen confirms his statement, that the right valve is less inflated than the left one, which he appears to have thought might have been only accidental in his type specimen; he makes no remark regarding the habitat.

DESCRIPTION OF PLATE."

- Fig. 1.— 1*b*. *Leptoconchus Robillardi*, p. 5.
2.— 2*a*. *Cylichna lactuca*, p. 2.
3.— 3*a*. *Cylichna involuta*, p. 3.
4.— 4*d*. *Pisidium Clarkeanum*, p. 9.
5. *Robinsonia Ceylonica*, p. 4.
6.— 6*a*. *Robinsonia pusilla*, p. 3.
7.— 7*a*. *Cataulus Nietneri*, p. 7.
8.— 8*a*. *Helicina Theoboldiana*, p. 8.
9.— 9*a*. *Fossarus insignis*, p. 4.
10.— 10*a*. *Fossarus Stoliczkanus*, p. 4.
11.— 11*c*. *Nucula Rabaniana*, p. 9.
12.— 12*a*. *Ringicula apicata*, p. 3.
13.— 13*b*. *Glaucionella Andersoni*, p. 2.
14. *Niso pyramidelloides*, p. 5.
15.— 15*a*. *Mangelia bicinctula*, p. 6.
16.— 16*a*. *Cryptogramma Arakana*, p. 10.
17. *Gibbulina Adamsiana*, p. 17.
18. *Gibbula Holdsworthana*, p. 3.
19. *Syrnola dubiosa*, p. 5.
20.— 20*a*. *Cypricardia spathulata*, p. 10.
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A LIST OF THE REPTILIAN ACCESSION TO THE INDIAN MUSEUM, CALCUTTA, FROM 1865 to 1870, WITH A DESCRIPTION OF SOME NEW SPECIES,—by JOHN ANDERSON, M. D., F. L. S. & F. Z. S.

[Received 28th October, read 2nd November, 1870.]

The accompanying list is a rough record of the number of species and specimens of Reptiles, added to the Indian Museum during the last four and a half years, with an enumeration of the localities from whence they were obtained. The Museum is especially indebted to Messrs. Jerdon, W. T. Blanford, Stoliczka, Theobald, Gammie, Peal, Godwin-Austen and Haughton for many valuable donations. The Museum collectors who have visited many parts of India during the above period, have also largely contributed to the collections in this Department. Two hundred and fifty-five species have been received during these four and a half years and about 60 of them are either new or recently described species. They illustrate 113 genera and number in all 1768 specimens.

A great deal, however, remains yet to be done, before sufficient materials will have been brought together for the full and exhaustive illustration of the distribution and variation of the Reptile fauna of our Eastern possessions, &c., and it may not be out of place to indicate here the localities from whence Reptiles are most required. Chief among these are, the North Western Provinces, Marwar, Bikaner, Sind, the North Western Himalaya, Assam, the Khasi Hills, Arakan and Burmah, Southern India and Ceylon, especially the four last mentioned localities.

Much has yet to be learned regarding the frogs, lizards and land and fresh water tortoises, and more especially of the smaller species of the two former groups.

The new species described in these pages have been received during the above period.

SCINCIDÆ.

Euprepes novem-carinatus, *n. sp.*

Supranasals form a suture behind the rostral. Eyelid scaly. Præfrontals, postfrontals and vertical meet in a point. Seven upper

labials, the 5th the longest. Ear obliquely oval with two or three strong prominent denticulations. Thirty-two longitudinal lines of scales round the body and 42 transverse lines between the axils. Scales with 9 keels, the three central ones strongly marked. The limb reaches to the anterior angle of the eye ; hind limb as long as two-thirds of the distance between the axils.

Above olive brown with 4 or 5 narrow longitudinal black lines along the back. A deep brown band from the nostril through the eye and above the ear, along the side and on to the base of the tail, with a moderately white band above far over the supercilium along the side of the back ; another through the upper labials and ear to the shoulder where it changes into the pale greenish yellow of the side. A very faint broken blackish line from the angle of the mouth to the shoulder and three or four from behind the fore limb along the side of the belly. Limbs with five longitudinal black lines with scattered white spots.

Length of body 3", 10" ; tail 4", 4".

Hab. Mandalay, Upper Burmah.

The nine keels, strongly denticulated ear, and the greater number of scales between the axils and round the body separate this species from *E. rufescens* apud Günther, or *E. macularius*.

***Euprepes longicaudatus*, n. sp.**

Tail long and tapering, three and one half the length of the body. A long narrow linear supranasal, not contiguous with its fellow. Posterior frontals form a broad suture. The anterior frontal is partially divided, vertical moderate tapering behind. Fifth upper labial below the eye, much elongated ; opening of the ear of moderate size, no lobules. Thirty longitudinal series of scales round the body and 28 transverse series between the fore and hind limbs. Præanals not enlarged, scales with 4 to 6 keels, 4 the prevailing number. Fore limb, when laid forward, reaches to the anterior angle of the eye ; the posterior extremity covers 4-5ths of the internal between the groin and the axilla. Limbs of moderate strength. Upper surface and sides uniform dark brown, lower parts pale greenish white ; vent to snout 1", 6" ; vent to tip of tail 3", 9' ; fore limb $\frac{7}{16}$ " ; hind limb $\frac{10}{16}$ ".

Hab. Cachar.

This form is closely allied to *E. monticola* from which it is distinguished by the greater number of the keels on its scales and by the length of its tail. It is in all probability a hill form.

GECKOTIDÆ.

Hemidactylus Bengaliensis, n. sp.

Body uniformly granular. An enlarged white tubercle on the side of the neck before the shoulder. No enlarged tubercles on the sacral region. Tail flattened from above downwards, flat on the under surface, contracted at the base and then expanded into broad verticils. A prominent almost spiny tubercle directed backwards on the posterior inferior margin of each verticil, with or without a small tubercle above it on the dorsal and lateral margin. The perfect tail a little longer than the body. Eight or nine femoral pores, not continued on to the preanal region. Thirty-five longitudinal series of scales on the middle of the abdomen. The rostral with a longitudinal groove on its upper surface. A pair of moderately-sized rounded plates behind the rostral, separated from each other by two granules, placed longitudinally and forming the upper margin of the nostrils. Two small plates enter into the posterior margin of the nostril, the first labial defining it below. Fifteen upper labials, the hinder ones very small. Eleven lower labials. Two large shields behind, broadly in contact with each other, and forming a suture with the sides of the mental and with the first labial. A pair of small shields on the external side of the post mentals. Two irregular lines of small shields of variable size below the lower labials. Twelve transverse imbricate plates in double series on all the fingers, except the thumb which has only 10, the distal on all, and sometimes the proximal, being undivided. Fingers all clawed, the claw of the thumb being very small. The upper surface of each finger is covered with about 5 longitudinal lines of enlarged almost scaly granules, the interval between them and the disks being occupied by minute granules. Thirteen imbricate plates in double series on the second and third toes, the distal and proximal ones being undivided; twelve on the 4th and 5th toes, the proximal ones being single or partially divided,

the distal one single. All the toes clawed. The scale-like granules on the upper surface arranged as on the fingers.

Brownish grey olive, with 5 to 6 transverse, broad, wavy, brownish bands, with pale posterior margins on the back, and 12 to 13 more indistinct bands on the tail with the angle directed backwards. Sides faintly reticulated with brown. Under surface pale yellowish, brightest on the middle of the abdomen. Disks bright silvery white in life. Length 2," 11", tail 3", 2" = 6", 1".

This species is common in Bengal, and is closely allied to *H. Coctei*, from which it is distinguished by the tubercle on the side of its neck, by the absence of the tubercles on the sacral region, the spiny character of the lateral caudal tubercles and the smaller tubercle above it, the greater number of its upper labials and by its coloration.

***Nycteridium Himalayanum*, n. sp.**

Head rather flat : snout broader, flatter and more rounded than in *N. Schneideri*. Fingers and toes with a more developed membrane. Uniformly granular above, with the exception of a line of large, round, flat, scale-like granules along the sides from behind the fore limb to the loin. Thirty-six longitudinal rows of scales in the middle of the belly. Two pairs of mental shields, the anterior nearly twice as large as the posterior. Eleven upper and eight lower labials. A line of small shields above the upper labials. A pair of supranasals behind the rostral, the two separated by a small azygos shield. Tail broken off.

Uniform greyish above with a shining lustre, marbled with blackish in short lines. A dark line far behind the eye along the side, minutely punctulated with black, a spot to each granule most numerous on the limbs, the sides of the body and head ; under surface yellowish.

The rather strongly webbed feet of this species would seem to connect *Ptychozoon* and *Nycteridium*. The glands behind the ear in the position of the paratoids are prominent structures, filled with a white cheesy substance. Darjeeling ; 3,000 feet.

OLIGODONTIDÆ.

Simotes semifasciatus, *n. sp.*

Scales in 17 rows, occipital suture little more than half the length of the vertical. Occipitals but little larger than the vertical, rounded or obliquely truncated behind. Eight upper labials, the 4th and 5th entering the orbit. Loreal longer than high. Two præoculars and two postoculars. Temporals 1 + 2 or 1 + 1 + 2, or 2 + 2; one only in contact with the postoculars, but when there is a small anterior temporal, this shield is in contact with the two postoculars. Upper postocular wedged in between the supraciliary and the occipital. Ventrals 181, C. 34. Anal entire? Length 8", 5"', tail 2", 3"', ventrals with an obtuse keel. Uniform brown above, with 50 obscure, irregular, narrow, broken, transverse, black bands, formed by the black margin of the scales, not continued on to the second row of scales. Under surface dull yellowish with numerous quadrangular large black spots on the ventrals and caudals, obscure on the anterior eighth of the body. All the scales minutely punctulated with brown.

Two specimens, Naga Hills, Assam.

COLUBRIDÆ.

Zamenis Ladacensis, *n. sp.*

Head rather long; snout pointed, the rostral as broad as high, pyramidal. Anterior frontals as broad as long, their greatest length being from within outwards, about half the size of the posterior frontals. Mesial suture of posterior frontals obliterated, but a small portion of the united shield is separated on the right side; vertical much contracted in the middle, its anterior end broad. Occipitals proportionally larger, than in *Z. fasciolatus*, transversely truncated behind. Loreal almost square. One large præocular reaching the vertical with a small detached piece below, separated from the 3rd and 4th upper labials. Nine upper labials, the 4th and 5th entering the orbit, the posterior upper extremity of the latter prolonged up behind the orbit. The upper half of the 6th distinct, but excluded from the orbit by the 5th. Two posterior

* The snake has been cut open through the anal.

oculars in contact with two temporals. Temporals 2 + 2, nineteen rows of smooth scales with two apical pores, ventrals with a distinct keel, most marked on the middle and hind part of the body. Anal bifid, ventrals 237, caudals 102. Pale olive brown, marked on the anterior half of the body by broad brown dorsal bands only a little darker than the general colour of the snake, distinct near the anterior part of the body, but obscure behind. Ventral surface pale yellow, faintly marbled with brown on the under surface of the tail. Nine teeth in each maxillary, the last stronger than the others.

Ladak, where it is said to be the only snake inhabiting that elevated region.

***Tropidonotus Sikkimensis*, n. sp.**

Head of moderate size, obtusely rounded in front; scales in 19 rows, feebly keeled, much imbricate on the anterior half of the body and disposed in very oblique rows. Ventrals 166—170, caudals 64—66. Rostral much broader than high. Anterior frontals more than half the size of the posterior pair, obtusely truncated in front. Lateral margins of vertical broader than anterior margin, convergent. Posterior margins of occipitals rounded, occipitals longer than vertical, supraciliary nearly as large as vertical. One quadrangular loreal higher than broad. Præocular just reaching the upper surface of the head. Three postoculars, eight upper labials, the 4th and 5th entering the orbit. Temporals 2 + 2 in contact with all the postoculars, the inferior anterior are about 4 times as large as the superior. Two pairs of elongated chin shields, the posterior divergent behind, anterior in contact with five lower labials. Twenty-five small teeth in each maxillary, scarcely separated from two strong teeth behind them. Anterior half of the body olive green, darkening posteriorly to olive brown, reticulated posteriorly with white and black, involving the margins of the scales. Under surface pale yellow, the ventrals on the anterior third of the body with large blackish brown spots, that sometimes cover a whole shield; then the posterior thirds minutely speckled with dark purplish brown; the angles of the ventrals of the same colour. The upper side of the head is uniform olive, but all the upper labials and rostral are pale yellow; in front of the eye pale olive brown, no black spot below the eye.

Darjeeling, 5000 feet.

This description is drawn up from two specimens* that agree in every particular. It is closely allied to *G. subminiatus* and *T. himalayanus*, but distinguished from them by its dentition, the relatively fewer number of its caudal plates and by its distinctive coloration.

HYDROPHIDÆ.

Hydrophis tuberculata, n. sp.

Head slightly broader than the neck and of moderate length. Neck not very slender. Rostral broader than high. Fourth and fifth labials below the eye; one præocular and two postoculars. Three to four temporals along the side of each occipital, the anterior one the largest and almost entering the labial margin. The nasals are large and quadrangular, and much larger than the frontals which are rounded behind. The vertical is emarginate and much smaller than the elongated occipitals.† All the shields of the head, including the lower labials and the scales in the immediate vicinity of the head, are thickly studded over with minute granules. Thirty-eight rows of slightly imbricate scales round the neck, each scale with two prominent tubercles, one before the other. Ventrals 321, small, about twice the size of the adjoining scales, irregular, sometimes dividing, those on the fore part of the body largest. Each ventral with several minute tubercles on either side. Four anal shields, the external the largest. Terminal scale of tail moderately large, tuberculated at its base. Trunk encircled by 59 black bands, 8 black bars on the tail. The bands are broadest and blackest on the back, contracting on the sides into narrow indistinct lines, continued on to the ventral surface. Ground colour olive yellow above, bright gamboge yellow below. A dark olive patch on the crown of the head with a pale yellowish band from orbit to orbit, and passing backwards through the temporals to the neck. An obscure dark line through the upper labials which are yellowish. Length 49 inches.

* No. 1. Length $35\frac{1}{2}$; tail $7\frac{1}{8}$. No. 2. Length $34\frac{3}{4}$; tail 7.

† Two large pairs of square-shaped chin-shields in contact with each other and four of the lower labials.

Hab. Tidal streams, Calcutta.

This species is very closely allied to *H. granosa* from which it is separated by the small number of scales round the neck, by its two postoculars and two pairs of large chin-shields and by differences in the form of the shields of the head.

***Hydrophis Fayreriana*, n. sp.**

Head short and thick, snout broad, rounded; body moderately long, stout, of nearly equal breadth throughout and narrower on the anterior fifth. Frontal shields large, tapering outwards, about the same size as the nasals. One præocular, small and pointing forwards. One postocular. Seven upper labials, the 5th the largest, the 6th and 7th labials with a shield above them, suggesting that they are only portions of a large 6th labial. Third and fourth labials entering the orbit, oblong, higher than broad. The front lower labials form a suture behind the mental and are succeeded by a number of scale-like shields. Thirty-four rows of smooth, scales round the neck. Those on the ventral surface larger than those on the back and sides, and slightly imbricate, no enlarged ventrals; 193 scales from the chin to the vent. Five pairs of small præanal shields.

Thirty-nine broad olive brown cross bands on the back, extending to the sides, but not on to the belly, rounded below, separated by narrow pale lines about half a scale's breadth. Tail olive brown above, black on its lower third. Length 30", 2''' ; tail 3", 1''' ; gape 6."

Hab. Bay of Bengal, Pooree Coast.

This species appears to be closely allied to *H. Hardwickii*, from which it is distinguished by the absence of tubercles in the adults, the partial imbrication of the middle rows of scales on the belly, by their greater number &c.

***Hydrophis crassicollis*, n. sp.**

Head hardly distinct from the neck. Neck and body of nearly equal girth throughout. Round neck 2", 2''' , round middle of body 2", 9''' . Body elongated. Thirty-four series of scales round the neck, 40 round the middle of the body. Scales almost smooth on

the neck and anterior third of the body; two feeble keel-like tubercles, one before the other, very obscure, but more strongly developed on the two posterior thirds, ventrals twice the size of the adjoining scales, quite smooth, broken up here and there on the posterior five eighths of the body. Two pairs of anal shields, the central pair of moderate size, elongate, the external pair very large. The vertical is pointedly linquate. One præ- and two post-oculars. The 3rd, 4th and 5th labials enter the orbit on one side, but only the 3rd and 4th on the opposite side, the 5th being transversely divided into two shields which do not reach quite as high as the orbital margin. Two pairs of large chin shields, the anterior pair quadrangular, and the posterior pair rather elongated. Olive yellow above, yellowish on the sides and under surface, 62 broad black bands on the back, contracting to a point on the sides, but prolonged very indistinctly on to the sides and central aspect, when they expand as a large blackish spot. Near the tail the dorsal bands become connected together, and their continuations on the central aspect follow a similar arrangement. Six black rings on the tail, confluent below; the latter third entirely black. Length (total) 4 feet, 5", 6"; tail 4", 3". Hughli, below Calcutta. The peculiarity of this species is its elongated body, the uniform breadth which it preserves throughout its length and its enlarged and smooth ventrals.

CROTALIDÆ.

Hypnale affinis, *n. sp.*

Snout short, triangular, slightly concave above, canthus rostralis prominent; point of snout turned up, with the linquate shaped rostral directed forwards and upwards, capped by 4 small and rather nodular scales; frontals broken up in a number of small scales, symmetrically arranged. Occipitals as large as supraciliaries, irregularly shaped and tending to divide in the middle, irregularly truncated behind, one in one direction and the other in another. Three præoculars forming the posterior boundary of the loreal pit. Two postoculars, the lower one very large, forming the edge of the eye and reaching to the lower præocular. Two large temporals, widely separated from the occipitals and diminishing in size from before backwards. Eight upper labials, the second forms the lower mar-

gin of the loreal pit. The posterior labials are very much smaller than the third and fourth and only half as high. Scales in 19 or 20 rows, moderately keeled, ventrals 148-155, subcaudals 36-35. Anal entire. Tail terminating in a convex almost spiny scale.

There are two varieties of coloration, the markings being the same; one is light reddish brown and the other dark brown. A series of large, round, dark brown spots either opposite or alternate along each side of the back, confluent on the posterior fourth of the body, with a lateral series of smaller and more indistinct spots below them, with another line of still smaller spots on the first series of scales and angles of ventrals. All the scales and the ventrals finely mottled with brown. A narrow longitudinal brown band along the side of the neck corresponding to the second line of spots. A broad yellowish brown band from behind the eye through one half of the temporals, downwards behind the angle of the mouth to the side of the neck between the second and third line of spots. A shoe-shaped brown band, the front of the shoe forwards, on the occiput and nape. A brown band from below and behind the eye through the lower two thirds of the temporals and from the posterior half of the third labial round the angle of the mouth, on a line with the lowest line of spots. Fifth to 8th upper labials each with a yellowish spot. Two yellow spots below the angle of the mouth.

This species is distinguished by the greater number of scales round the body, their stronger carination, the greater number of its upper labials and the relatively lesser height of the small posterior labials to those below the eye.

RANIDÆ.

Rana Gammii, *n. sp.*

Snout short, moderately pointed and rounded, with indistinct canthus rostralis. Tympanum hidden or very indistinct, one-half the diameter of the eye. Lower jaw with a pair of not very prominent apophyses, vomerine prominences of moderate size, placed nearly transversely with an interval between them. Skin generally smooth, but with a very few small tubercles on the sides and sacral region in some, others smooth throughout. A fold joining the posterior angle of the eyelids. A glandular fold from the eye over the tym-

panic region to the shoulder, and another from behind the eye along the side of the back to the groin. Hind limb of moderate length. The distance between the vent and the heel a little longer than the body. An oblong flat tubercle at the base of the first toe, and a fold along the 1st and 5th toes. The 3rd and 5th toes are almost subequal, the 4th being the longest. Tips of toes and fingers slightly swollen. Toes completely and broadly webbed, the membrane reaching to the tips of all the toes and not emarginate.

Olive grey above, marbled on the back with blackish brown. A black band between the eye and the snout and another from the posterior angle of the eye to near the shoulder. A black band between the eyes. The posterior half of the lateral glandular fold is yellowish. A brown blackish band below the lateral fold from behind the eye to the groin. About 8 black bars on the upper jaw and 12 on the lower; the chin faintly speckled with greyish. Fore limbs and fingers black spotted. Sides with from 6 to 8 black spots. Legs barred and marbled with brownish. Toes barred with black and marbled with paler. Under surface yellowish, brighter on the under and hinder surface of the thighs.

Another specimen from the same locality (Darjeeling) has the sides and sacral region tubercular and the legs very feebly so. The colour above is uniform (in spirit) dark slate, marbled with darker. Around the vent there is a loose circular bay, marked by radiating lines, thickly studded over by papillæ, each capped by a chitinous, curved, sharp process.

Length of ♂ 2", 7"; hind leg 4", 2". Length of ♀ 2", 10"; leg 5", 2". Males without vocal sacs.

Habitat. Darjeeling, 4000 feet.

Dr. Jerdon* in a late notice of some reptiles mentions a frog from Darjeeling somewhat allied to *R. Liebigii*, but distinguished from it by its more fully webbed feet. Such is his description and he applies to it the name *R. sikimensis*. I have no means of determining whether this frog is or is not the one now described, as Dr. Jerdon gives no additional details regarding it.

* Proceedings Asiatic Society, Bengal, 1870, p. 83.

Pxyicephalus Khasianus, n. sp.

Body short and thick, legs of moderate length. Head short and broad. Snout short and rounded; no canthus rostralis; nostrils directed upwards and backwards, almost on the upper surface and half way between the eye and the snout. Eyes rather large and prominent. Occiput much swollen. Tympanum inverted by the skin, but faintly visible, small, one half the diameter of the eye. Skin in the groin full, smooth throughout, no trace of tubercles, fingers quite free; three small tubercles on the palmar aspect, the inner one the largest, elongated and simulating the shovel-like tubercle of the metatarsus. The first and second fingers of nearly equal length, about a half shorter than the third; the fourth about one third shorter than the third. Thighs rather short, lower leg little shorter than the thigh. Tarsus and foot the length of the thigh and one half of the tibial portion. The body very little longer than the distance between the vent and the heel. The shovel-shaped prominence laterally compressed, but not prominent. Two apophyses on the lower jaw. The choanæ are round, more distinctly defined, but rather smaller, than the eustachien tubes; vomerine prominences placed transversely behind the choanæ and separated from each other by a narrow interval. Tongue rather small, cordate and notched behind.

Uniform brown above, faintly barred on the thigh; spotted with brown on the sides, chin, thorax and under-surface of the limbs.

Hab. Khasi Hills.

The position and direction of the vomerine prominences and the small size of the metatarsal tubercle almost serve to separate this form as the type of a new genus.

POLYPEDATIDÆ.

Hylorana granulosa, n. sp.

Of moderately slender habit. Canthus rostralis distinct, rounded. Snout of moderate length, pointed. The interval between the eyes is equal the distance from the anterior angle of the eye to the nostril. Nostril below canthus rostralis near the end of the snout. Loreal region longitudinally concave. Tympanum nearly as large as the eye. Vomerine teeth in two, somewhat oblique, ridges near the

internal margin of the choanæ, converging, but separated by a narrow interspace. Tongue rather elongately cordate, deeply notched. A strong glandular fold at the side of the back from the eye to the loin. Two glands at the angle of the mouth, one behind the other, not prolonged on to the side as a glandular fold. Limbs of moderate length; disks rather small. Fingers slender and of moderate length. The first is rather longer than the 4th, and the 2nd is considerably shorter than the latter; the third is more than one half longer than the 4th. The 4th toe is if anything less than one half of the body. Two well developed metatarsal tubercles, the inner one oblong, the outer one round and prominent. Toes two-thirds webbed. From the vent to the metatarsal tubercle is considerably more than the length of the body. The back is closely granular with a few scattered tubercles, more especially on the sacral region. Tubercles not visible in the supposed young. Head almost smooth. Sides of the body of the adult with small and large tubercles.

Olive brown above, paler on the glandular line of the sides. A dark band from the nostril to the eye. A dark brown band from behind the eye along the side. A narrow white streak from below the eye along the glandular fold behind the mouth. Upper lip olive brown. Chin and throat dusky. Thorax, abdomen, sides, fore limbs, and front and back of femora yellowish, reticulately spotted with brown, the reticulations strongest on the back of the thighs. Upper surface of legs barred with brown to the feet.

In a specimen, which appears to be the young of this species from Pegu, the colours are more marked than in the adult, more especially the pale colour of the dorsal glandular lines which is prolonged forwards as a pale margin to the upper eyelid and canthus rostralis. The light colour of the glands behind the mouth is prolonged along the sides as an indistinct line, also showing itself to a certain extent in the adult, which the young resembles in all the other details of coloration.

The young specimen was obtained in Pegu by Mr. Theobald and the adults at Seebaugor, Assam. The former measures: length 1", 2", hind limb 1" 11"; the latter: length 2", 2", hind limb 3", 6."

I first described this species in my notes from a specimen I obtained in Yunan.

***Hylorana monticola*, n. sp.**

Snout of moderate length, very little longer than the distance between the eyes. Moderately pointed, canthus rostralis triangular or nearly so. Loreal region between the nostril and eye flat, perpendicular and then abruptly rounded outwards to lower jaw. Nostril directed backwards and outwards, slightly below the canthus rostralis and nearer the end of the snout than the eye. Upper jaw not projecting much beyond the lower one. Tympanum distinct, small, about one third the size of the eye. The tongue cor-date, hardly elongated, deeply notched behind. Choanæ hemispherical; the vomerine ridges begin on a line with their anterior internal angle in two oblique lines, increasing in size from before, backwards converging, but separated by a considerable interspace. The eustachian openings are rather larger than the choanæ. A glandular fold along the side of the back, with a very indistinct one from the tympanum to the shoulder. A few enlarged glands behind the mouth, with a short fold meeting the one from the tympanum and ceasing behind the shoulder. From the vent to the heel is slightly in excess of the length of the body. The length of the foot is about half the length of the body. Disks large. The thumb is a little shorter than the second finger which is about one fourth shorter than the fourth. The third finger is one third longer than the fourth. Toes broadly webbed, the membrane reaching to the disks of all fingers except the fourth.

Dark slate colour above, obscurely marked with large darker spots. A deep bluish black band from the nostril through the eye and tympanum, and along the sides on which it expands, and is obscurely spotted with darker. A pale bluish line from the eye along the glandular fold. Upper surface of legs greyish, obscurely banded and mottled with slaty brownish. Back of thighs finely reticulated with brown. Under surface yellowish. Upper lip, post-oral glands and fold yellowish, faintly mottled with dark slaty. A narrow slaty streak along the margin of the lower jaw. A dark bluish black broken band from the angle of the mouth downwards

and backwards along the forepart of the humerus, separated from the general dark slaty of the arm by a narrow yellowish streak. Below, the elbow and the bands barred with blackish.

Length of body 2", 10"; hind limb 5", 2".

Darjeeling, 3,500 feet.

The single fold along the back, the small tympanum, the smooth skin and the coloration of this species separate it from all its fellows. Only one specimen has come under my observation.

***Polypedates tuberculatus*, n. sp.**

Head of moderate size; snout rounded and somewhat pointed. Canthus rostralis indistinct rounded. Nostrils below it near the tip of the snout. Tympanum about two-thirds the size of the eye, vomerine prominences close to the internal angle of the choanæ, rounded and small, with a large interspace between them. Tongue moderately long, deeply notched behind. Fingers broadly webbed, the membrane reaching the disks of the second and fourth fingers. Disks of fingers large, about one-third larger than those of the toes. A small oblong metatarsal tubercle. Length from the vent to the metatarsal tubercle considerably larger than the body. A strong fold from the eye over the tympanum to the shoulder. Skin smooth above. Abdomen finely granular with numerous moderately sized round tubercles; under surface of thighs granular, with scattered large round tubercles.

Upper surface uniformly deep brown in spirit. Brownish yellow below with a blackish region round the vent, a short way along the thighs. The tubercles of the abdomen and thighs are darker. Faint black banding on the tibiæ and femora. Some specimens with a violet spot on the tip of the snout, another before the eye and a broad violet band with dark margins from the eye along the side to the groin.

Longest specimen 1", 8"; thigh 8"; leg 9"; tarsus 5"; metatarsus and toes 7".

This species is intermediate between *Polypedates* and *Rhacophorus*. In its general form, in the wide interspace between its vomerine processes, it is strongly affined to the latter, while its smaller disks and the incomplete webbing of its toes affine it to

Polypedates. I was at first inclined to refer it to *Rhacophorus*, but prefer now to locate it provisionally as I have now done.

Hab. Seebaungor, Assam.

***Rhacophorus maculatus*, n. sp.**

Rhacophorus Reinwardtii, Jerdon, Proc. As. Soc. Beng. 1870, p. 84.

Head very short and broad, of moderate size, snout rather shorter than in *R. maximus*, Günth. This distance between the eyes is the length of the snout, and about one half the distance between the nostrils is broader than the interval between them. Nostrils near the extremity of the snout below the canthus rostralis. Canthus rostralis indistinct, rounded. Tympanum rather indistinct, about one half the longer diameter of the eye. A very feeble fold over the tympanum, vomerine teeth in two transverse ridges from the anterior internal angle of the choanæ, with a moderately wide interval between them. Upper surface smooth; abdomen and under surface of thighs granular.

Violet above, with a few scattered minute white and black spots, the former only in the adult. Yellowish below, the chin and throat occasionally with a few black spots. A large intensely bluish black spot on the side behind the arm, with a smaller one on a line with it posteriorly; rather occasionally absent in the young. Both minutely speckled with violet.

Length 2", 3"; hind limb 3", 5".

Hab. Khasi Hills.

I have five specimens of this frog from the Khasi Hills, and in all the above characters are persistent. Dr. Jerdon referred this form to *R. Reinwardtii* from which it is distinguished by the persistent black spots on the side, the white and black spotting of the back in adults and the invariable absence of the spots on membrane of the fingers and toes.

***Ixalus punctatus*, n. sp.,**

Habit rather stout. Head rather broad and rounded. Length of the snout is a little more than the breadth between the eyes. Canthus rostralis distinct; the nostril nearer the end of the snout than

the eye. Tympanum distinct, about one-third the size of the eye. The choanæ smaller than the eustachian tubes. The back nearly smooth with a few scattered minute tubercles on the sacral region. Finely tubercular on the sides, on the under surface of the body and femora; the tubercles anterior to the thorax being less numerous than on the belly. A fold from the eye over the tympanum to the shoulder. Limbs of moderate length; disks well developed. The first finger is shorter than the second and the latter than the third; the fourth reaches only to the end of the third joint of the third. From the vent to the metatarsal tubercle is the length of the body. Metatarsal tubercle small. Toes less than one-third webbed; disks not so large as on the fingers.

Back brownish (spirit specimen), as far forwards as the anterior angle of the eye where the brown abruptly ceases in a straight line, the upper surface of the snout being light olive grey. The brown of the back obscurely spotted with darker. Sides bluish grey, the minute tubercles dark brown. Under surface dirty yellowish, the chin, throat and thorax with scattered brown spots. A dark brown band from the snout to the tympanum. A white line along the canthus rostralis and margin of eyelid and supratympanal fold. Upper lips white. A brown spot in the axilla and a large elongated one in the groin. A dark brown band on the back of the thighs at some distance internal to the vent.

This description is drawn up from a frog in the Museum labelled *I. tinniens*, Jerdon, from the Nilgiris.* In Dr. Jerdon's specimen of that species, the body was $1\frac{1}{10}$ and the hind leg $1\frac{3}{10}$ while in the frog that yields this description, the body is $\frac{9}{10}$ and the hind limb $1\frac{3}{10}$, which would seem to indicate that the former was a frog of a very different habit of body from the latter. There are no other points in Dr. Jerdon's account of *Phyllomedusa? tinniens*† to assist in identifying the frog he had in view, and from the circumstance that he makes no mention of the tubercular sides and under surface, and does not enumerate any of the striking features of the coloration of the form just described, I believe it to have been wrongly referred to *P. tinniens*. He describes an *Ixalus glandu-*

* Collected by Mr. Theobald.

† Journal As. Soc. Beng. vol. XXII, p. 533.

*losa** with a largely glandular abdomen and slightly webbed feet, but the characters are so vaguely given, that the description is of no practical value.

***Ixalus lateralis*, n. sp.,**

Snout short as long as the eye, rounded in front; canthus rostralis angular and rounded. Tympanum about one-third the size of the eye. Tongue linear, elongate, slightly notched behind. Eustachian tubes about the same size as the choanæ. Skin smooth above; sides and sacral region with a few minute scattered tubercles. A fold from the eye over the tympanum to the shoulder, terminated over the latter in a rather prominent white tubercle, under surface smooth, limbs moderately long. The tips of the fingers and toes very feebly dilated. Second finger slightly longer than the first, and the third than the former. Fifth about one-half the length of the fourth. Foot rather short, the fourth toe less than one half the length of the body. The first toe very small, about one half the length of the second. The third toe is its distal phalanx longer than the fifth, and the latter reaches only to the distal end of the second phalanx of the fourth. Toes one-fourth webbed, an elongated metatarsal tubercle at the base of the first toe. From the vent to the heel is the length of the snout shorter than the body.

Uniform brown above (spirit specimen). Three black spots, with a white spot in the centre of some, in linear series along the side. A lower oblong black spot on the side of the sacrum above the groin. A narrow white line on the middle of the side between the fore and hind limbs. A black band along the supratympanal fold. A few black spots above the vent. Back of the thighs black, with a white spot at the end of the band. Legs barred with black. Under surface brownish yellow.

Length 1", 1", hind limb 1", 10".

The habitat of this species is unknown. I found it in a bottle along with a specimen of *Xenophrys monticola* and labelled *Hylorana*—?

* Ibidem p. 532.

LIST OF ACCESSIONS

to the collection of Reptiles in the Indian Museum, since 1865.

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<i>Puellula rubida</i> , Blyth, (<i>Cyrtodactylus rubidus</i> apud Stoliczka)— Andamans,	...	1
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„ <i>Emma</i> , Gray,—Goalpara (Assam), Ponsee (Kukhyen Hills, Upper Yunan),	...	3
<i>Salea Horsfieldii</i> , Gray,—Madras,	...	1
„ <i>Jerdoni</i> , Gray,—Nilgiris,	...	2
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<i>Stellio tuberculatus</i> , Gray,—Koteghur,	...	1
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„ <i>subgriseus</i> , D. and B.,—Doomercoonda, (Bengal),	...	1
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„ <i>collaris</i> , Gray,—Darjeeling, Khasi Hills, Jyntea Hills and Hotha, (Yunan);	...	18
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„ <i>bicolor</i> , Blyth,—Khasi Hills,	...	2
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„ <i>fasciolatus</i> , Shaw,—Calcutta,	...	2
„ <i>brachyurus</i> , Gthr.,—Berar,	...	1
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<i>Lycodon striatus</i> , Shaw,—Lahore, Simla and Agra,	...	3
<i>Tetragonosoma effrene</i> , Cantor,—Island of Banca,	...	1
<i>Leptorhytaon jara</i> , Shaw,—Calcutta, Garo Hills, Cachar and Assam,	..	5
<i>Ophites</i> , n. sp., (And.),—Momien Yunan,	...	1

AMBLYCEPHALIDÆ.

<i>Pareas monticola</i> , Cant.,—Darjeeling, Khasi Hills and Assam,...	3
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PYTHONIDÆ.

<i>Python molurus</i> , Schneider,—Eastern Bengal, Cachar and Wellesley Province,	...	4
„ <i>reticulatus</i> , Linn.,—Pegu and Nicobars,	...	2

ERYCIDÆ.

<i>Gongylophis conicus</i> , Schneid.,—Bengal (Western),	...	1
<i>Eryx Johnii</i> , Russell,—Agra,	...	5

ELAPIDÆ.

<i>Naja tripudians</i> , Merr.,—Bengal, Simla, Darjeeling, Upper Burma and Andamans,	...	37
<i>Ophiophagus elaps</i> , Schlegel,—Calcutta, Darjeeling, Moulmein and Andamans,	...	5
<i>Bungarus cœruleus</i> , Schneider,—Calcutta, Agra, Central Provinces, Darjeeling and Assam,	...	13
„ <i>fasciatus</i> , Schneid.,—Calcutta, Dacca, Cachar, Mandalay and Upper Burma,	...	12
<i>Callophis intestinalis</i> , Laur.,—Upper Burma,	...	1
„ <i>Maclellandi</i> , Reinh.,—Assam,	...	1
„ <i>maculiceps</i> , Gthr.,—Rangoon,	...	1

HYDROPHIDÆ.

<i>Platurus Fischeri</i> , Jan.,—Hughli,	...	1
<i>Hydrophis coronata</i> , Gthr.,—Tidal streams, Calcutta,	...	1
„ <i>tuberculata</i> , n. sp. And.,—ditto,	...	1
„ <i>crassicollis</i> , n. sp., And.,—ditto,	...	1
„ <i>gracilis</i> , Shaw,—Hughli,	...	1
<i>Enhydrina valakadyen</i> , Boie,—Orissa, Hughli and Tidal streams, Calcutta,	...	11
„ <i>schistosa</i> , Daud,—Gopalpore,	...	1
<i>Pelamis platurus</i> , Linn.,—Pooree and Ceylon,	...	2

CROTALIDÆ.

<i>Trimeresurus gramineus</i> , Shaw,—Darjeeling, Assam, Andamans and Ponsee (Yunan),	...	5
„ n. sp., (And.),—Upper Burma,	...	1
„ <i>carinatus</i> , Gray,—Calcutta, Darjeeling, Garo Hills and Moulmein,	...	
„ <i>erythrurus</i> , Cantor,—Naga Hills (Assam), Cachar, Burma and Java,	...	11
„ <i>porphyraceus</i> , Blyth,—Andamans,	...	1
„ <i>Cantoris</i> , Blyth,—Andamans and Nicobars,	...	6
„ <i>mutabilis</i> , n. sp., Stol.,—ditto,	...	5
„ <i>monticola</i> , Gthr.,—Darjeeling, Khasi Hills and Kukhyen Hills, Upper Yunan,	...	9
„ <i>convictus</i> , Stol., n. sp.,—Penang,	...	1
„ <i>strigatus</i> , Gray,—Nilgiris,	...	1
„ n. sp. And.,—Hotha,	...	2
<i>Halys Himalayanus</i> , Gthr.,—Simla,	...	2
<i>Hypnale affinis</i> , And., n. sp.,—Ceylon,	...	2

VIPERIDÆ.

<i>Daboia Russellii</i> , Shaw,—Calcutta, Kulu, N. W. Himalaya, Ran- goon and Upper Burma,	...	54
<i>Echis carinata</i> , Schneid.,—Singhbhúm (Bengal) and Agra,	...	2

Batrachia salientia.

RANIDÆ.

<i>Rana</i> , n. sp., (And.),—Prome,	...	2
„ <i>Kuhlii</i> , Schleg.,	...	0
„ „ var., <i>chinensis</i> , And.,—Prome and Hotha,	...	32
„ <i>Gammii</i> , n. sp., And.,—Darjeeling,	...	4
„ <i>tigrina</i> , Daud.,—Calcutta, Agra, Assam, Upper Burma, and Yunan,	...	49
„ <i>cyanophlyctis</i> , Schneid.,—Calcutta, Orissa, Nagpore and Chanda (C. Provinces), Assam,	...	32
„ <i>gracilis</i> , Wieg.,—Central Provinces, Nilgiris, Assam, Garo Hills, Khasi Hills, Upper and Lower Bur- ma, Penang and Andamans,	...	48
„ „ var., <i>nicobariensis</i> , Stol., Nicobars,	...	2
„ „ var., <i>pulla</i> , Stol.,—Penang,	...	3
„ „ var., <i>andamanensis</i> , Stol.,—Andamans,	...	2
„ n. sp., (And.),—Ponsee, Kukhyen Hills,	...	2
<i>Pyxicephalus beviceps</i> , Schneid.,—Agra and Simla,	...	37

DICROGLOSSIDÆ.

<i>Xenophrys monticola</i> , Gthr.,—Darjeeling and Khasi Hills,	...	15
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RHINODERMATIDÆ.

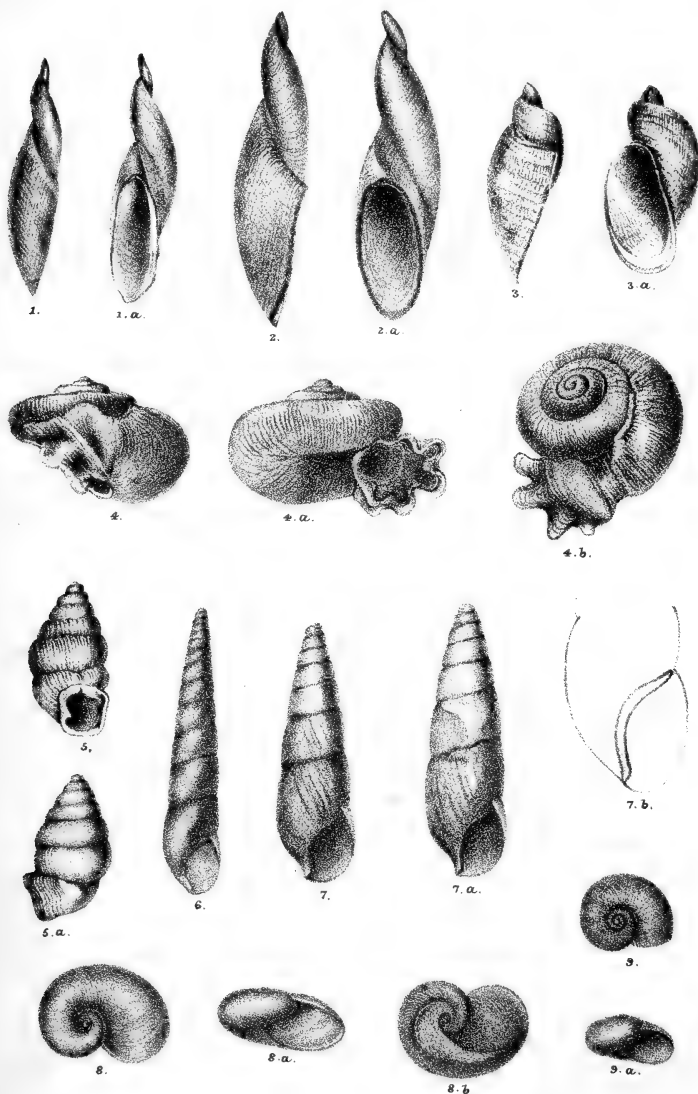
<i>Diplopelma carnaticum</i> , Jerdon,—Martaban,	...	1
„ n. sp., (And.),—Prome,	...	1
„ <i>rubrum</i> , Jerdon,—Killore, Carnatic,	...	2
„ <i>pulchrum</i> , Jerd.—Pegu,	...	7
<i>Ansonia Penangensis</i> , Stoliczka,—Penang,	...	2
<i>Cacopus systoma</i> , Schneid.,—Agra,	...	11
„ <i>globosus</i> , Gthr.,—Calcutta,	...	1

BUFONIDÆ.

<i>Bufo pantherina</i> , Boie,—Agra,	...	25
„ <i>viridis</i> , Laur.,—Simla,	...	2
„ <i>calamita</i> , Laur.,—Kashmir,	...	1
„ <i>Sikkimensis</i> , Blyth,—Darjeeling,	...	1
„ <i>melanostictus</i> , Schneid.,—Calcutta, Central Provinces, Nilgiris, Agra, Koteghur, Assam, Khasi Hills, Upper and Lower Burma, Yunan, Penang, Singapore, Andamans and Nicobars,	...	106

POLYPEDATIDÆ.

<i>Hylorona granulosa</i> , And., n. sp.,—Assam, Pegu and Hotha (Yunan),	...	5
„ <i>Nicobariensis</i> , Stol., n. sp.,—Nicobars,	...	5
„ <i>macrodactylus</i> , Gthr.,—Pegu,	...	1
„ <i>flavesceus</i> , Jerdon,—Malabar,	...	3
„ n. sp., (And.),—Moulmein,	...	1
„ <i>erythraea</i> , Schleg.,—Khasi Hills,	...	7
„ <i>monticola</i> , And., n. sp.,—Darjeeling,	...	1
<i>Ixalus cinerascens</i> , Stol., n. sp.,—Moulmein,	...	1
<i>Polypedates maculatus</i> , Gray,—Calcutta, Central Provinces, Darjeeling, Cachar and Pegu,	...	18
„ <i>quadrilineatus</i> , Wieg.,—Assam,	...	10
„ <i>Hascheanus</i> , Stol., n. sp.,—Penang,	...	3
„ <i>smaragdinus</i> , Blyth.,—Khasi Hills,	...	4
„ <i>marmoratus</i> , Blyth.,—Darjeeling, Khasi Hills, Pongsee and Kukhyen Hills,	...	10
„ <i>pleurostictus</i> , Gthr.,—Nilgiris,	...	2
„ <i>tuberculatus</i> , And., n. sp.,—Assam,	...	5
„ <i>annectans</i> , Jerdon, n. sp.,—Khasi Hills,	...	4



1. *Camploceras terebra*, Bens.

2. *Austeni*, H. Blf.

3. *lineatum* "

4. *Alycaeus digitatus*, "

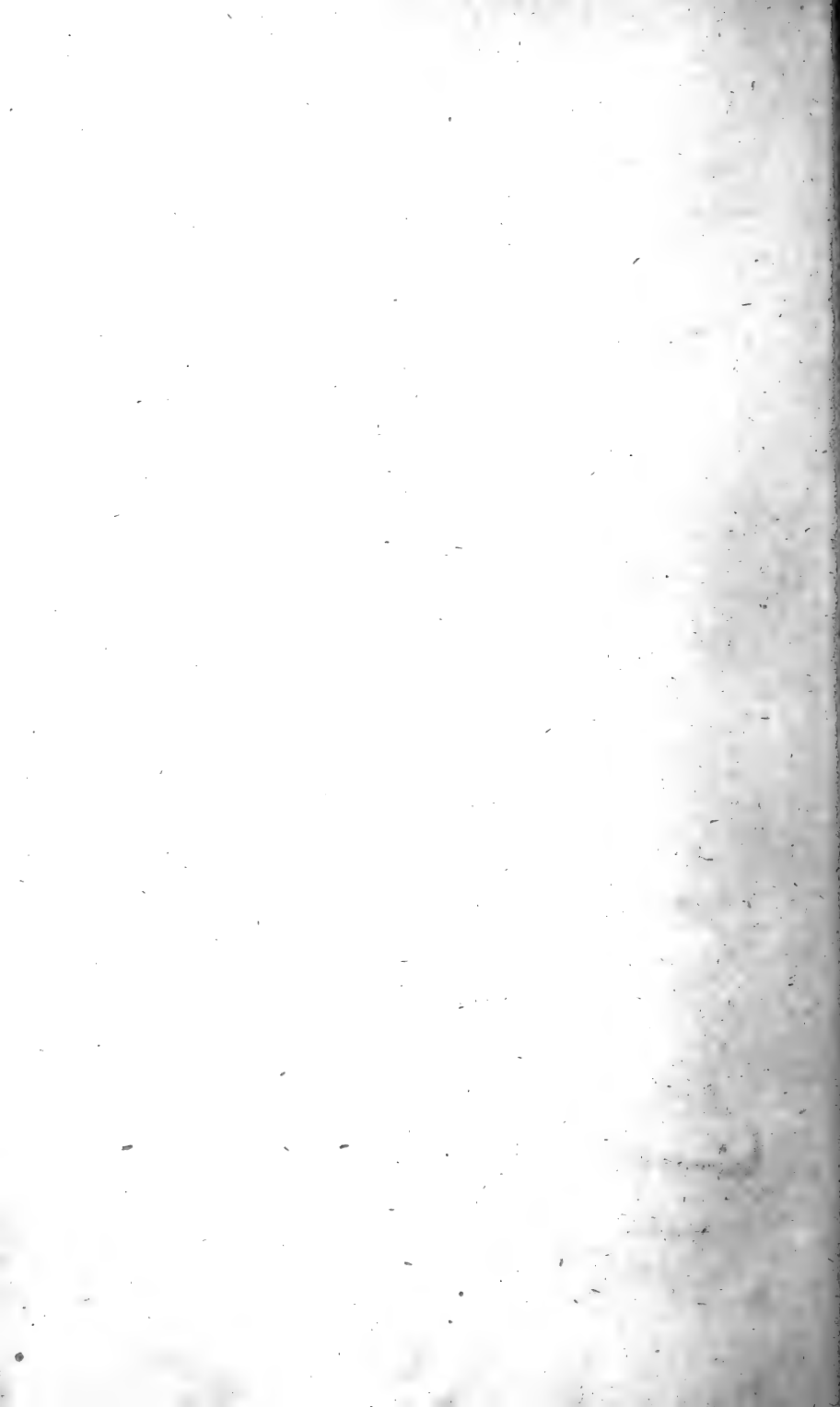
5. *Diplommatina unguolata*, H. Blf.

6. *Glossula baculina* "

7. " *erosa* "

8. *Helicarion heteroconcha* "

9. *Helicarion ovatum*, H. Blf.



1871.]	H. F. Blanford— <i>On Camptoceras, &c.</i>	39
	<i>Rhacophorus maximus</i> , Gthr.,—Assam, Khasi Hills and Jyntea Hills,	... 18
	„ <i>maculatus</i> , n. sp., And., Khasi Hills,	... 4
	HYLIDÆ.	
	<i>Hyla chinensis</i> , Gthr.,—Hotha and Ponsee, Yunan,	... 34
	HYLÆDACTYLIDÆ.	
	<i>Callula pulchra</i> , Gray,—Calcutta, Lower and Upper Burma,	... 7
	Batrachia gradientia.	
	SALAMANDRIDÆ.	
	<i>Hydrodactylus</i> , n. sp., And.,—Yunan,	... 12

ON SOME UNDESCRIBED SPECIES OF CAMPTOCERAS AND OTHER LAND SHELLS, *by* HENRY F. BLANFORD.
(With plate II.)

[Received 2nd December, read 7th December, 1870.]

Of the species, now described, the two new forms of *Camptoceras* were obtained recently by Major Godwin-Austen in Eastern Bengal. The *Alycaeus*, and I believe the *Diplommatina*, were originally found by myself many years since at Darjeeling. The *Glossula* and *Helicarions* from the same place were obtained by Mr. Atkinson and Dr. Stoliczka.

The discovery of two new forms of a genus, hitherto known only as represented by the type species *C. terebra*, Bens.; is of great interest; the more so that one of the new forms exhibits in only a slight degree the abnormal character of the typical species, while the other has this character as strongly marked as *C. terebra*; to which indeed it is closely allied. The conditions of habitat under which Major Godwin-Austen found his specimens are somewhat different from those of *C. terebra*, described by Mr. Benson. Major Austen is not, however, sure that the specimens were living at the time that he met with them, and it is quite compatible with the circumstances, that *C. Austeni* and *C. lineatum* should, like *C. terebra*, naturally live beneath the water.

I may note that *C. terebra* (see pl. II, fig. 1,) has never been met with by any collector, either at Moradabad or elsewhere, since its original discovery by Dr. Bacon and Mr. Benson.

Camptoceras Austeni, nov. sp. Pl. II, fig. 2.

Testa sinistrorsa, elongata, albido cornea, epidermide tenui induta, striis spiralibus et transversis minutissime obliquiter decussata. Spira elongato acuminata. Apex acutiusculus. Anfractus 2, soluti. Apertura subobliqua, regulariter ovalis, supernè haud complanata. Peristoma integrum, continuum, fusco-marginatum.

Alt. 3.75, diam. 1 mm.—Aperturæ alt. 1.6, diam. 0.9 mm.

Cepit Major H. H. Godwin-Austen herbæ adhærentem, margine desiccato lacus, *beel* dicti, apud Nazirpûr haud procul a Shushong, provinciæ Mymensing, patriæ Bengalîæ.

In form this species closely resembles *C. terebra*, Bens., but is distinguished by its much smaller size, the smaller number of its whorls, and especially the regular oval form of its aperture; that of *C. terebra* being much flattened on the inner upper margin. Other differences are presented by the specimen of the latter species here figured, (fig. 1) and which I received some years since from the late Mr. Benson. The aperture of *C. terebra* is equal to more than half the length of the shell, while that of *C. Austeni* is less than half the same length; the proportions in the former case, as determined by accurate measurement, being 53 per cent., in the latter 42 per cent. My specimen of *C. terebra* is probably not full grown, since it has but $2\frac{1}{2}$ whorls, and the margin of the peristome is sharp, unlike that of the specimens both of *C. Austeni* and the following species. All the specimens of these exhibit a thickening of the epidermis around the peristome, which I consider characteristic of the full grown shell. *C. Austeni* would appear to be rare at the locality, since only five specimens were found among a large number of the following species. It is possible, however, that it may have been overlooked, owing to its smallness.

Camptoceras ? lineatum, nov. sp. Pl. II, fig. 3.

Testa elongate ovata, sinistrorsa, albido cornea; epidermide tenui induta; lineis elevatis, fuscis, æquidistantibus, spiralibus ornata; interspatiis minute decussatis. Spira valde exserta. Apex acutiusculus. Anfractus $2\frac{1}{2}$, approximati, attingentes; ultimus pone aperturam omnino solutus. Apertura subobliqua, ovalis, superne

subcomplanata. Peristoma continuum, integrum, fusco-marginatum.

Alt. 4.5 mm. ; diam. 2.3 mm.—Aperturæ alt. 3.5, lat. 1.7 mm.

Habitat cum præcedente.

It is not with entire confidence that (not having seen the animal) I attribute this species to the genus *Camptoceras*, since it differs from the typical species in having the whorls contiguous, except behind the peristome. In most specimens that I have examined, little more than the peristome is free, but in one or two, at least a quarter of the last whorl is not in contact with the penultimate whorl, as may be seen if the shell be held up to the light, or over a sheet of white paper in a proper position. The character of the peristome and of the shell surface closely resemble those of the more typical species of *Camptoceras*, and that the habits of the animal are similar, may be inferred from its association with the preceding species. As far as can be judged, therefore, the evidence is preponderant in favour of this generic alliance I have adopted. Perhaps it may not be irrelevant to add that no species of *Physa* has yet been discovered in India.

***Alycæus digitatus*, nov. sp. Pl. II. fig. 4.**

Testa solida, depresso turbinata, umbilicata, albido-cornea, regulariter costulata ; pone aperturam usque ad tubulum striata. Spira parum exserta, apice obtusulo. Anfractus 4, rotundati ; ultimus inflatus, deinde constrictus, iterum abrupte expansus, denique abrupte constrictus, antice depressus et in 5 plicationes validas desinens. Tubulus post constrictionem oriens, recurvatus, $\frac{1}{2}$ anfractus subæquans. Sutura impressa. Apertura perobliqua. Peristoma duplex ; externum simplex, evertatum ; internum continuum, superne valde prolongatum, 5-plicatum. Plica basalis abrupte recurvata. Operculum corneum, extus concavum.

Alt. 3.6 mm. ; diam. major 5.5 ; minor 4 mm.

Aperturæ alt. 2.25, lat. 2.75 mm.

Habitat apud Darjeeling in vallo Rungno fluminis Himalayæ Sikkimensis.

Of all the *Alycæi* yet described with plicate peristomes, this exhibits the character in the most exaggerated degree ; the free

portion of the lip being prolonged into five digitiform folds, nearly a millimetre in length. The ridge-shaped fold between the two constricted portions is very abrupt, as in *Alycæus plectocheilus*, which species, together with an yet unpublished form found by Major Godwin-Austen in the Khasi Hills, are its nearest allies. In some specimens, taken alive, the costulation has disappeared from the greater portion of the upper whorls, and remains only in patches; so that on a cursory inspection, the whorls appear to be smooth and striate; it is most distinct on the inflated portion of the shell.

I found a single specimen of this shell in 1856, in the Rungno valley. Some years afterwards I received several specimens from Mr. W. S. Atkinson, which were taken, I believe, near the station of Darjeeling.

Diplommatina ungulata, nov. sp. Pl. II. fig. 5.

Testa dextrorsa, ovato-conica, subrimata, tenuis, costulata, cereo-albida. Spira superne conica; sutura impressa; apex obtusulus. Anfractus 7; duo primi lævigati, ceteri confertim costulati; antepenultimus major, tumidus; penultimus supra aperturam constrictus; ultimus valde ascendens, ad basin rotundatus. Apertura subobliqua, subquadrata; plica columellaris mediocris. Peristoma subduplicatum, margine dextro evertato, juxta suturam sinuatum, in expansionem angustam unguiformem, antice productum; subtus rectum. Callus columellaris late appressus.

Alt. 3 mm.; diam. vix 2 mm.—Aperturæ alt. 1 mm., lat. 1 mm.

Habitat apud Darjeeling.

The only species yet described that presents anything resembling the peculiar conformation of the lip exhibited by this species is the rare *D. scalaria*, W. Blanford, from the Khasi Hills, and it is scarcely discernible in some specimens even of this species, which moreover presents no other point of marked resemblance. In all the specimens I have seen of *D. ungulata*, it is strongly marked; in some, however, more so than in others.

I have had five or six specimens for some years in my collection labelled as from Darjeeling, but I am uncertain whether I found them myself, or received them from Mr. Atkinson. Dr. Stoliczka recently found several specimens, about 600 feet below the station

of Darjeeling, among dead leaves on moist ground. The animal is white, with the tentacles dusky and the upper part of the rostrum reddish coloured.

Glessula erosa, nov. sp. Pl. II. fig. 7.

Testa elongato-turrita, crassula, parum nitens, haud diaphana, longitudinaliter oblique striata, epidermide fusco-straminea induta. Spira turrita, lateribus convexiusculis; apice truncato. Anfractus apicales carentes; superstites 7 sub-planati; superiores plerumque plus minusve decorticati et erosi; sutura impressa. Apertura obliqua, postice angulata, intus lactea. Peristoma simplex, acutum. Columella leniter arcuata, ad basin oblique truncata.

Alt.,	35	36	34 mm.
Diam.,	10	10.5	9 mm.
Aperturæ alt.,	10	10	9 mm.
„ lat.,	5	5	5 mm.

Habitat apud Darjeeling.

This species is easily distinguished from its local associate *G. tenuispira*, Bens., by its thickness and opacity, and by the character of the surface, which has none of the vitreous lustre so characteristic of most species of the genus. The upper whorls are generally much eroded; the lower, which retain the epidermis, are of a dark straw colour with darker oblique bands at intervals, apparently marking stages of growth. Under a lens very fine dark spiral lines are also perceptible.

I received several specimens of this shell in 1863 from Mr. W. S. Atkinson, but it has not hitherto been described. It appears to be a rare species. Dr. Stoliczka only got two specimens in forest at the waterfall about 1000 feet below Darjeeling.

Glessula baculina, nov. sp. Pl. II. fig. 6.

Testa elongato-turrita, gracilis, tenuiscula, oblique striata, fusco vel fulvo cornea, epidermide nitescens induta. Spira turrita, apice obtusulo. Anfractus 13½, parum convexi; inferiores sub-æquales; sutura impressa, minute denticulata. Apertura obliqua, ovato-triangularis; peristoma simplex, acutum. Columella abrupte arcuata, oblique producta, ad basin verticaliter truncata.

Alt. 38 mm. ; diam. 6.5-7.5 mm.—Aperturæ alt. 7, lat. 4 mm.

Cepit Dr. F. Stoliczka apud Khersiong Himalayæ Sikkimensis.

This species appears to have escaped the notice of all previous collectors in Sikkim ; it was found in association with its near ally *G. tenuispira*, Bens., by Dr. Stoliczka during a recent visit. It is easily distinguished from the latter species by its slenderness, (the diameter being $\frac{1}{6}$ of the length), and the comparative narrowness of its whorls ; moreover by the form of the columella, the lower part of which is bent abruptly almost at right angles with the slope of the inner lip ; while in *G. tenuispira*, *G. erosa*, and other allied forms, the curvature is at the utmost obtuse. Specimens, the shell of which has been slightly weathered, shew fine spiral markings ; but these are not visible unless the shell has become somewhat opaque. The animal is dark leaden grey, somewhat paler at the sides of the foot.

The following is a list of the species now known from Sikkim :—

G. tenuispira, Bens., *G. crassula*, Bens., *G. hastula*, Bens., *G. orobia*, Bens., *G. erosa*, nob., *G. baculina*, nob.

Helicarion ovatum, nov. sp. Pl. II. fig. 9.

Testa depressa, peripheriâ ovatâ, solidiuscula, diaphana, fusciscente cornea, polita, obsolete arcuatim striata. Spira parum convexa ; apice vix exserto. Anfractus $3\frac{1}{2}$, rapide accrescentes ; ultimus descendens. Sutura impressa, marginata. Apertura obliqua, depressa lunata. Peristomatis margo columellaris subverticalis ; basalis leniter arcuatus.

Diam. major 11.5 mm., minor 9 mm., axis 5 mm.

Aperturæ alt. 5, lat. 7 mm.

Cepit Dr. F. Stoliczka apud Darjeeling.

Distinguished from *H. salius*, Bens. sp. (with which it is associated,) by its larger size, more depressed form and simple peristome, not recurved at the columella. On the other hand, it is smaller, more solid and more globular than *H. planospira*, Bens. sp. From *H. scutella*, Bens. sp., and *H. Bensoni*, Pfr. sp., it differs by its greater solidity, its highly polished surface and the less rapid increase of the last whorl. It is also smaller than the former of these species.

Helicarion heteroconcha, nov. sp. Pl. II. fig. 8.

Testa valde depressa, peripheriâ ovali, tenuis, diaphana, subtus membranacea, luteo cornea, versus aperturam viridicans, polita, arcuatim obsolete striata, versus aperturam irregulariter subcostulata. Spira planata, apice vix exserto. Anfractus 3, rapide accrescentes; ultimus dilatatus vix descendens. Sutura subimpressa, albido marginata. Apertura perobliqua, oblongo-ovata. Peristomatis margo anterior antice valde arcuatus; margo dexter subundulatus; margo basalis membranaceus.

Diam. major 17, minor 11 mm., axis 5 mm.

Aperturæ alt. 8, lat. 11 mm.

Habitat apud Darjeeling.

This very pretty shell is very distinct from any species hitherto described from Northern India. It is probably allied to some of the Ceylon species which like it have a membranaceous base. I have had the specimens for some years in my collection. They were, I believe, obtained by Mr. W. S. Atkinson.



ON SOME NEW OR IMPERFECTLY KNOWN INDIAN PLANTS, (continuation from Journal, Vol. XXXIX, part 2, pp. 61—91),—by S. KURZ, Esq.

[Received 2nd December, read 4th December, 1870.]

DILLENIA CEE.**1. DILLENIA PARVIFLORA**, Griff., (Not. Dicot., 704.)

Arbor vasta; folia oblongo-lanceolata, acuta v. breviter acuminata, longe et graciliter petiolata, repando-dentata, supra scaberrima, subtus dense tomentosa; flores mediocres, pedunculis longis tomentosis, vulgo ebracteatis, 2-4—nis, e ramulis verruciformibus orientibus sustenti; sepala dense pubescentia; staminum series interior exteriore duplo longior; styli carpellaque 5—7.—Pegu, Yomah (Dr. Brandis).

This is a very distinct species, very much resembling in foliage *D. scabrella*, Roxb., but the flowers are quite different.

2. *DILLENIA SPECIOSA*, Griff. (Not. Dicot., 703, t. 649 f. 3) = *D. aurea*, Sm.

3. *Dillenia pulcherrima*, n. sp.

Arbor mediocris v. *parva* ; folia (etiam juvenilia) longiuscule petiolata, decidua, obovata v. oblonga, repando-dentata, obtusa v. subobtusa, glabra ; flores speciosi, lutei, longe stricteque pedunculati, solitarii, in ramulis anni præcedentis terminales ; series staminum interna externâ longior ; styli et carpella circiter 12 ; fructus calyce carnoso accreto inclusi, circ. $1\frac{1}{2}$ poll. in diametro, Burma (Dr. Brandis).

Closely allied to *D. aurea*, but differing in the shape of the leaves and in the long, straight peduncles.

POLYGALEÆ.

4. *SKAPHIUM LANCEATUM*, Miq., (in Suppl. Flor. Sumatr. p. 357).—This supposed new genus is placed by Prof. Miquel in the THYMELEACEÆ, but it is clearly a species of *Xanthophyllum* (ex affinitate *X. glauco*).

TERNSTRÆMIACEÆ.

5. *Pyrenaria camelliæflora*, n. sp.

Arbuscula, 25-30-pedalis, ramulis petiolisque dense pubescentibus ; offlia 4-5 poll. longa, oblonga v. elliptico-oblonga, utrinque subacuminata, breviter petiolata, (petiolis glabris v. puberulis), crenato-serrulata, basin et apicem versus integra, subcoriacea, glabra, subtus costâ magis minusve pubescentea, etiam in sicco lutescenti-viridia ; flores parviusculi, circiter 8 lin. in diametro, lactei (antheris aureis), in foliorum axillis subsessiles ; bracteolae parvae, unacum sepalis petalisque extus sericeae ; ovarium sericeum ; styli 5 ; drupae....—Martaban, Doyokee pass, 4000 feet, (Dr. Brandis).

MALVACEÆ.

6. *Hibiscus sagittifolius*, n. sp.

Herba annua, erecta, scabriuscule pubescens, mox glabrescens, 1—3 pedalis ; folia valde variabilia, inferiora minora, lata, basi cordata v. truncata, superiora magna, saepius 6-7 poll. longa, oblongo-lanceolata v. linearia, basi valde hastata, acuminata, longe

petiolata (petioli raro laminae longitudinem attingentes, pubescentes), grosse crenato-dentata, supra glabra, subtus parce hispidula; flores circiter 2 poll. in diametro, pedicellis longis, scabro-hispidulis, petiolorum longitudine v. longioribus suffulti; involucrium e foliolis 7—11 linearibus hispidis, calycis spathacei decidui velutini longitudine, v. longioribus, compositum; capsulae oblongae, acuminatae, hispidae, 5-angulares.—Pegu. (Dr. Brandis).

7. *HIBISCUS VESTITUS*, Griff., (Not. Dicot. 519) = *H. vulpinus*, Bwdt.

STERCULIACEÆ.

8. *BUETTNERIA ANDAMANENSIS*, Kurz, (in Andam. Report, App. B., p. 3).

Frutex scandens, glaber, novellis parce puberulis; folia cordato-ovata, petiolis 3-5 pollicaribus, glabris v. subglabris, breviter 3—5-lobata, lobis acutis v. acuminatis, rarissime subintegra, acuminata, irregulariter et grosse dentata, membranacea, adulta utrinque glabra et vulgo secus costas paullum puberula, quoad valde juvenilia molliter pubescentia; flores graciliter pedicellati, cymas di-trichotomo-ramosas, minute puberulas, axillares formantes; capsulae globosae, cerasi magnitudine, glabrae, setis inaequali-longis, strictis, laevibus obtectæ.

Martaban, along the Thouigyeen and Attaran rivers (Dr. Brandis). Closely resembling in habit, &c., *B. pilosa*, Roxb., but it is quite glabrescent and the capsules are very different.

TILIACEÆ.

9. *Pentace Burmanica*, n. sp.

Arbor novellis puberulis v. pubescentibus?; folia oblonga v. ovato-oblonga, 4—6 poll. longa, basi rotundata v. obtusa et crasse 3-nervia, (cum nervis accessoriis 1 v. 2 tenuioribus), petiolati (petiolis $\frac{1}{2}$ — $\frac{3}{4}$ poll. longis, glabrescentibus), acuminata, integra v. sinuata, chartacea, supra glabra et nitentia, subtus pallida et, præsertim secus nervos, parce puberula; flores iis *Berryi mollis* similes; pedicelli longiusculi, fulvo-tomentosi, paniculas terminales laxas dense fulvo-tomentosas formantes; calyx

5-fidus, circ. 2 lin. longus, extus tomentosus, lobis lanceolatis et subregularibus; petala obovato-oblonga, basi attenuata, lobis calycinis paululum longiora; stamina circiter 4—7, 5-delpha, phalanges cum staminodiis totidem lineari-subulatis alternantes; ovarium globosum, 5-lobum, tomentosum; capsulæ immaturæ 5-loculares et 5-alatæ, molliter fulvo-tomentellæ; valvæ alâ latâ apice truncatâ et angulatâ circumdatæ.—Martaban, Poungyee. (Dr. Brandis).

10. *Elæocarpus bracteatus*, n. sp.

Arbor magna, glabra, gemmis parce sericeis; folia obovato-oblonga v. obovata, 5-6 poll. longa, basin acuminatam versus attenuata, petiolata (petiolis $\frac{1}{2}$ -1 poll. longis, glabris), obtusa v. obtuse apiculata, repando-dentata, coriacea, glaberrima; flores majusculi, albi; pedicelli pollicares, glabri, racemos glaberrimos bracteatos axillares formantes; bracteae foliaceae, obovatae, sessiles, glabrae, serrato dentatae, $\frac{1}{3}$ -1 poll. longae, verosimiliter persistentes; sepala 6-7 lin. longa, lineari-lanceolata, acuminata, glabra, marginibus revolutis velutina; petala paulum longiora, cuneato-oblonga, bifida, (lobis fissis et subulato-ciliatis), extus parce sericea, intus secus margines revolutos sericeo-pubescentia; stamina numerosa; antherae aristâ subulatâ terminatae; ovarium sericeo-villosum; drupae pruni magnitudine, oblongae, laeves; putamen lacunosum et tuberculato-rugosum.—Martaban, Thoungyeen (Dr. Brandis).

RUTACEÆ.

11. *Evodia gracilis*, Kurz, (*Fagara triphylla*, Roxb., Fl. Ind. I, 416).

Fruticulus habitu *E. edulis*, Forst., gracilis, 3-5 pedalis, ramulis terretibus, novellis inflorescentiaque puberulis; folia 3-foliolata, (raro unum alterumve 1-foliatum,) opposita et subalterna, glabra; petiolis vix marginatis, glabris, 1-4 pollicaribus; foliola $3\frac{1}{2}$ -4, non raro 5-7 poll. longa, lanceolata v. lato-lanceolata, utrinque acuminata, breviter petiolulata, chartacea; panicula contracta et petiolo communi multo brevior, puberula, glabrescens; flores parvi, albidii, pedicellis brevibus et gracilibus puberulis suffulti; petala 4, oblongo-lanceolata, acuta; ovarium puberulum, 4-loculare; carpella vulgo 4, matura 2-3 lin. longa, punctata, glabra; semina grani

pipervis nigri magnitudine, lucida, aterrima v. fusco-atra.—Burma, Karen hills, Taipo mountains, 3000 ft., (Dr. Brandis).

Roxburgh's plant has been wrongly identified with Loureiro's *Lepta triphylla*; it is quite a distinct species.

12. GLYCOSMIS SAPINDOIDES, Ldl., will probably turn out to be only a form of *G. chlorosperma*, Spreng.

OCHNACEÆ.

13. OCHNA CROCEA, Griff., (Not. Dicot., 463) = *Gomphia Sumatрана*, Jack.

MELIACEÆ.

14. *Schizochiton dysoxylifolium*, n. sp.

Arbor glabra; folia magna, pinnata, iis *Dysoxyl*i *acuminatissimi* simillima, rhachide glabrâ; foliola alterna, breviter et crasse petiolulata (petiolulis puberulis), parum inæqualia, oblonga, v. oblongo-lanceolata, acuminata, integrâ, subcoriacea, glabra, 10—12 poll. longa; flores 6 lin. circiter longi, tubulosi, subsessiles, bracteolâ parvâ lanceolatâ pubescente sustenti, breviter racemosi, paniculam magis minusve pubescentem formantes; calyx campanulatus, obsolete 4-dentatus, subtilissime pubescens; petala 6 lin. circiter longa, pubescentia, obovato-lineararia; staminum tubus styli longitudine, petalis a medio adnatus, adpresse flavescente pubescens, apice 6-fidus, lobis oblongis, obtusis, integris, glaberrimis; antherae 6, cum lobis alternantes; ovarium stylusque basin versus pubescens, capsulae...—Martaban, Thoungyeen. (Dr. Brandis).

RHAMNACEÆ.

15. *Gouania integrifolia*, n. sp.

Frutex magnus, scandens cirrhiferus, novellis dense ferrugineo-tomentosis v. villosis; folia cordato-ovata, 2½–3½ poll. longa, petiolis magis minusve tomentosis, 3 lin. usque ad pollicem fere longis, acuta v. acuminata, integerrima, supra brevè pubescentia, subtus dense fulvescentè (secus nervos ferrugineo-) pubescentia; racemi axillares et terminales, ferrugineo- v. fulvo-tomentosi, sæpius ad ramulorum extremitates paniculati; flores...; capsulae 3–4 lin. longae, intra alas 3, rotundatas, glabras, minute puberulae, 3-valves; semina in valvis solitaria.—Pegu, (Dr. Brandis).

The entire leaves (in absence of the flowers) readily distinguish this species from *G. Mauritiana*, Lamk.—*G. Javanica*, Miq., has quite glabrous fruits and coarsely serrate leaves, but I can find no specific distinction between it and *G. Mauritiana*; and I believe that Blume was quite right in identifying the former plant with the Mauritian species.

SAPINDACEÆ.

16. *Nephelium hypoleucum*, n. sp. (*Sapindaceæ*, No. 1, Griff., Not. Dicot., 550 ?).

Arbor mediocris, glabra, novellis ferrugineo-puberulis; folia impari-pinnata, rachide subterete glabrescente; foliola 6—10 poll. longa, oblongo v. ovato-lanceolata, vulgo parum obliqua, basi acuta, subcoriacea, acuminata, glabra, subtus glauca et inter nervos subtiliter et tenuiter reticulata; flores minuti, pedicellati, paniculam axillarem et terminalem fulvo-puberulam formantes; calyx puberulus, dentibus sæpe ciliatis; filamenta longa, præsertim basin versus pilosa; fructus bilobi, v. vulgo lobo altero abortivo, pruniformes, molliter muricati, purpurei, monospermi; semina arillo eduli succulento induta.—Pegu, (Dr. Brandis).

Very near to *N. chrysceum*, Bl., but differing by the leaves.

ANACARDIACEÆ.

17. *Bouea Brandisiana*, n. sp.

Arbor glabra, novellis minute puberulis; folia lanceolata v. elliptico-lanceolata, longius v. brevius petiolata, longius v. brevius obtusiuscule acuminata, coriacea, in sicco opaca, nervis lateralibus utrinque impressis, glabra, novella subtus in nervis petiolisque puberula, mox glabrescentia; paniculæ magnæ, longe pedunculatæ, terminales, ramosæ, puberulæ, ramis pedunculoque 2-4—pollicari, glabrescentibus; flores iis *B. oppositifolia* majores, pedicellis 3 lin. longis, gracilibus, puberulis racemulosi; calyx minutus, puberulus, truncato-dentatus; petala obovato-oblonga, acutiuscula, lineâ longiora; stamina vulgo 8, omnia fertilia, filamentis brevibus filiformibus subpuberis; drupæ pruni majoris magnitudine, ovoideo-reniformes, læves, carnosæ, acidæ, purpurascenti-atræ?—Martaban, Thoungyeen, (Dr. Brandis).

18. *Semecarpus albescens*, n. sp.

Arbor magna, ramulis novellisq[ue] velutino-tomentosis; folia elongato-obovata v. cuneato-lanceolata, petiolis $\frac{1}{2}$ -1 poll. longis, crassis, tomentosis, 7-12—pollicaria, breviter et obtusiuscule acuminata, basi angustatâ, vulgo cuneatâ, rotundata v. obtusa, integra, coriacea, supra nitentia et (costâ minute pubescente exceptâ) glabra, subtus tenuiter albotomentosa et parce pilosula; nervi (et reticulatio laxa) conspicui, flavescentes, pilosuli, nec tomentosi; flores parvi, pedicellis 1-2 lin. longis, dense pubescentibus, racemulosi, in paniculam terminalem dense fulvo-velutinam, foliis vulgo brevioribus, dispositi; calyx minutus, pubescens; petala valvata v. subvalvata, lineam circiter longa, brevi pubescentia; ovarium dense adpresse hirsutum, stigmatibus 3 crassis, glabris; discus glaber; stamina 5, filamentis brevibus latiusculis, vulgo 1-2 abortiva et longiora; nux...—Pegu, Moung Forests, (Dr. Brandis).

LEGUMINOSÆ.

19. *Clanthus Binnendyckianus*, n. sp.

Herba perennis, erecta, ramosa, adpresse fulvo-villosa, ramis densius et patenter villosis; folia impari-pinnata, breviter petiolata, rachide fulvo-villosa; foliola 27-29, elliptica v. elliptico-oblonga, brevissime petiolulata, obtusa, mucronata, circ. 1 poll. longa, juniora dense et adpresse fulvo-villosa, dein supra parcius pubescentia; stipulæ subulato setaceæ, villosæ; racemi breviusculi, strictiusculi, axillares, longe pedunculati, folio vulgo longiores; bracteæ deciduæ, pollicem fere longæ, lineares, longissime subulato-acuminatæ, adpresse pubescentes; flores conspicui, mediocres, purpurei, pedicellis 4-5 lin. longis, fulvo-villosis, apice sub calyce bracteolas duas, lineari lanceolatas, calyce ipso paulo longiores gerentibus; calyx $2-2\frac{1}{2}$ lin. longus, fulvo-pubescent, dentibus brevibus; carina $\frac{3}{4}$ poll. longa, acuminata, vexillo reflexo longior; ovarium stylusque glaberrimus; legumen lineare, $3-3\frac{1}{2}$ poll. longum, breviuscule stipitatum, acuminatum, torulosum, coriaceum, nigrescens, glabrum, suturis incrassatis; semina nigra, circ. 2 lin. longa. Moluccos, Ceram. (Cult. in Hort. Bogor., et ab amiciss. Binnendyckio mecum communicata).

This plant resembles in habit *A. Dampieri*, but it is smaller in all parts and easily distinguished by the subulate bracts, etc. I have en-

tertained some doubts whether the species can belong to *Clanthus*, on account of the style not being bearded, but there are no other characters which could justify a separation from the genus.

ROSACEÆ.

20. *PRUNUS JAVANICA*, Miq.—To this species I add as synonyms *Prunus Junghuhniana* Miq., and *Prunus Martabanica*, Kurz, in Andam. Rep., Edit. secunda, p. 37.

21. *PYGEUM PARVIFLORUM*, T. et B., does not sufficiently differ from *P. arboreum*, Endl.

22. *RUBUS GOWREEPHUL*, Roxb., is identical with *R. flavus*, Ham.

R. albescens and *R. racemosus*, Roxb., as well as *R. Horsfieldii*, Miq., are all forms of *Rubus lasiocarpus*, Sm.

R. rosæflorus, Roxb., is *R. rosæfolius*, Sm., and

R. paniculatus, Roxb., is *R. fraxinifolius*, Poir.

CRASSULACEÆ.

23. *BRYOPHYLLUM CALYCINUM*, Salisb. This name must be changed, according to the laws of priority, in *B. pinnatum* (*Cotyledon pinnata*, Lamck., Enc. Meth., II, 141-1786).

HAMAMELIDEÆ.

24. *LIQUIDAMBAR TRICUSPIS*, Miq., is only a state of growth of *Bucklandia populnea*, R. Br. The leaves of the young shoots are usually lobed, those of the older ones often so, but rarely to an equal extent.

HALORAGCEÆ.

25. *MYRIOPHYLLUM INDICUM*, Griff. (Not. Dicot., 687), is *M. tuberculatum*, Roxb.

COMBRETACEÆ.

26. *COMBRETUM LEPIDOTUM*, Prsl. (Walp. Ann., I, 290,) is *C. squamosum*, Roxb.

Comb. rotundifolium, Roxb., and *C. Horsfieldii*, Miq., are both referable to *Comb. extensum*, Roxb.

27. LUMNITZERA COCCINEA, WA., is the same as *L. littorea*, Voigt, (Cat. Hort. Calcutt., 39 ;—*Pyrranthus littoreus*, Jack.).

MELASTOMACEÆ.

28. TREMBLEYA RHYNANTHERA, Griff., (Not. Dicot., 677), is identical with *Melastoma Malabathricum*, Linn.

29. *Allomorphia hispida*, n. sp.

Caules petiolique crassi, 5-pollicares, dense hispidi-setosi ; folia magna, ovata v. ovalia, basi subcordata, longe petiolata, breviter acuminata, integra, 8-9 poll. longa, tenui coriacea, supra sparse, subtus, præsertim secus costas 9, densius setosa ; paniculæ glabræ, vel ad nodos ramorum setosæ ; flores tetrameri, parvi, pedicellis gracilibus, 2-3 lin. longis, fasciculos sessiles formantes ; calyx 4-costatus, setis nonnullis longis instructus, brevi campanulatus et patens, dentibus minutis ; petala obovata, circ. 2 lin. longa ; stamina 8, antheræ connectivaque exappendiculata ; ovarium fundo calycis basi tantum adnatum.—Burma, (Dr. Brandis).

30. SONERILA ANGUSTIFOLIA, Roxb., *S. emaculata*, Roxb., *S. secunda*, Wall., (Walp. Rep., V. 685) and *S. picta*, Griff. (Not. Dicot. 676, non Korth.), all appear to be varieties of *Sonerila maculata*, Roxb.

31. *Sonerila Brandisiana*, n. sp.

Herba erecta, humilis, caulibus valde crassis et robustis, 2-3 poll. tantum longis et 3-4 lin. crassis, brunneis, apice ramos 1 v. 2 laterales, crassos articulatos emittentibus ; folia lanceolata, basi in petiolum breviorē v. longiorē attenuata, acuminatissima, remote et minute serrulata, flaccida et membranacea, glaberrima, supra maculis albis notata, 4-7 poll. longa ; racemi foliis multo breviores, secundi, glabri ; (flores desunt) ; capsulæ triquetrae, circ. 2½ lin. longæ, obovatæ, truncatæ, læves.—Martaban, Thoungyeen, (Dr. Brandis).

Evidently affined to *S. squarrosa*, although very different from it in habit and size.

32. *Sonerila amabilis*, n. sp.

Herbula 4-5-pollicaris, acaulis, parce pilosa ; folia numerosa, radicalia, variabilia, petiolis 2-3-pollicaribus, pilosis suffulta,

cordato-ovata minora sæpe reniformia, nonnunquam apicem versus angulato producta, obtusa, 1-2 poll. longa, tenere membranacea, sæpius obsolete crenata, ciliata, utrinque pilis longiusculis adspersa; scapi plerumque solitarii, foliorum longitudine, sparse pilosi, teretes, apice umbellato 3-5-flori; flores intense rosei, conspicui, longiuscule pedicellati; bracteæ minutæ, ovatæ, acutæ; calyx obovatus, longiusculis suberispis adpersus, circ. 2 lin. longus, lobis brevibus dentiformibus; petala oblonga, 3-3½ lin. longa, obtusa; antheræ ovatæ, acutæ, (haud prolongatæ uti in *S. scapiflora*, cui cæteris valde affinis), lineam tantum longæ; capsulæ calyce inclusæ, breves.—Sikkim-Himalaya, in shady, rocky places, in the Rangeet valley, at 4-5000 ft. elevation.

33. DISSOCHLETA ASTROSTICTA, Miq., (Suppl. Fl. Sumatr., 318), is *D. pallida*, Bl., perfectly agreeing with the Jackian plant from Singapore.

D. Palembangica, Miq., (l. c., 317), is identical with *D. pipericarpa*, Naud.

34. APTEUXIS TRINERVIS, Griff., (Not. Dicot., 672) is *Pternandra cærulescens*, Jack.

35. MEMEYCYLON HORSFIELDII, Miq., and *M. Lampongum*, Miq., (Suppl. Fl. Sumatr., 321) are synonyms of *M. Griffithianum*, Naud.

LYTHRARIÆ.

36. *Ammannia simpliciuscula*, n. sp.

Herbulæ decumbentes, basi repentes, radicanter, glabræ, 1-2½ poll. longæ, caulibus simpliciusculis, v. parce ramosis, filiformibus; folia opposita, oblonga v. oblongo-linearia, 2-5 lin. longa, superiora minora obovata, brevissime petiolata, obtusa, uninervia; flores minuti, coccinei, breviter graciliterque pedunculata, in axillis foliorum superiorum solitarii, vix ½ lin. in diametro; calyx truncato 4-denticulatus, hemisphericus; petala ..?; stamina 4; capsula subglobosa, ½ lin. in diametro, rubra, 3-valvis, 1-ocularis, calyce duplo longior.

On muddy ground around ponds and in inundated rice-fields at Chittagong, rare. Fl. Octob.

This is the third Indian species of *Ammannia*, which I have described as new. It may be desirable to give a conspectus of the Eastern Indian species, in order to shew the relations of these 3 species to others.

A. Flowers solitary, (or seldom and only occasionally 2-3), sessile, or pedicelled, in the axils of the leaves, forming often spikes or racemes ; capsules 2-3—valved.

α Calyx campanulate, twice as long as broad ; capsules about half so long as the calyx-tube, enclosed.

(1.) Leaves very shortly petioled, 1-nerved, linear ; flowers solitary, sessile ; pygmæan plant, *A. dentelloides*, Kurz.

(2.) Leaves usually sessile, strongly penninerved, obvate to oblong ; flowers sessile, forming lateral and terminal leafy or bracted spikes, *A. peploides*, Spreng.

(3.) Leaves sessile, almost orbicular, penninerved ; flowers on slender short pedicels, forming shorter or longer slender racemes, *A. subrotunda*, Wall.

(4.) Leaves sessile, orbicular or nearly so, penninerved ; flowers sessile in terminal peduncled, bracted, simple, or slightly compound, spikes, *A. rotundifolia*, Buch.

β Calyx hemispherical, about as long as broad ; capsules protruding from the calyx, or at least as long as the calyx-tube.

(5.) Leaves linear, 1-nerved, very shortly petioled ; calyx 4-angular and 4-toothed, about $\frac{1}{3}$ - $\frac{1}{6}$ lin. long ; no petals ; pygmæan herb, *A. pygmæa*, Kurz.

(6.) Leaves oblong to linear-oblong, 1-nerved, very shortly petioled ; calyx not angular, 4-toothed, about $\frac{1}{3}$ lin. long ; flowers very shortly peduncled ; pygmæan herb, *A. simpliciuscula*, Kurz.

(7.) Leaves oblong to linear, sessile, 1-nerved or the lateral nerves very faint ; calyx usually 5-toothed, not angular, $\frac{1}{2}$ -1 lin. long, petals 5, *A. pentandra*, Roxb.

B. Flowers sessile or more usually pedicelled, axillary, clustered or in cymes, the latter sometimes reduced to a 3-to-1 flowered cyme ; capsules irregularly bursting.

(8.) Leaves narrowed at the base, petioled or sessile ; flowers minute, apetalous, on slender penicels, forming sessile or very shortly peduncled cymes or clusters, *A. baccifera*, L.

(9.) Leaves sessile, with cordate, sagittate or dilate base ; petals present. Capsule under a line long ; stamens 4 or fewer ; petals flat ; calyx 4-toothed, without accessory teeth ; cymes slender, *A. multiflora*, Roxb.

(10.) Capsule about $1\frac{1}{2}$ lines long ; stamens 6—8 ; petals flat ; calyx 4-toothed, without accessory teeth ; cymes slender, *A. auriculata*, Willd.

(11.) Capsule about 2 line long ; stamens 8 ; petals large, crimped ; calyx 4-toothed, with as many horn-like accessory teeth ; cymes and pedicels short, robust, *A. octandra*, L. f.

37. AMELETIA ACUTIDENS, Miq., and *A. nana*, Roxb. (non. DC.) are both identical with *Ameletia Indica*, DC., now referred to *Ammannia peploides*, Spreng. (Syst. Veg., I, 444—1825 ;—*Peplis Indica*, Willd.).

38. AMMANNELLA LINEARIS, Miq., (Fl. Ind. Bat. I-1, 619, c. descriptione erronea), is identical with *Ammannia octandra*, L. f.

39. SUFFRENIA DICHOTOMA, Miq., is *Ammannia multiflora*, Roxb.

40. GRISLEA TOMENTOSA, Roxb. This name must be altered into *Woodfordia fruticosa*, (= *Lythrum fruticosum*, L., sp., pl. 641).

41. LAGERSTREEMIA REGINÆ, Roxb., (Corom. Pl., I, 46, t. 65,—1795). This name has to be replaced by the older one of Retzius, viz. *Lagerstrœmia flos-reginæ*, Retz., (Obs. Bot., I, 20,—1779).

42. SONNERATIA ALBA, Griff., (Not. Dicot., 652, non Sm.), is evidently a new species, very different from Smith's plant, and may be named *S. Griffithii*.

The species of *Sonneratia* may thus be distinguished.

A. Stigma infundibuliformi—capitatum, parvum ; calyx 6-8—lobatus ; folia lato-obovata.

(1.) Petala lineari-lanceolata, intense purpurea ; calyx teres, *S. acida*.

Petala desunt.

(2.) Calyx in alabastro elliptico-oblongus, acutus ; tubus obsolete, dein manifeste 6-8—angulatus, *S. alba*.

(3.) Calyx in alabastro ovoideus, obtusus ; tubus teres, *S. Griffithii*.

B. (4.) Stigma magnum, 3 lin. fere in diametro, fungiformis. calyx 4-lobatus ; petala nulla ; folia oblonga ad lanceolata, *S. apetala*.

ONAGRARIÆ.

43. JUSSIÆA FLORIBUNDA, Griff., (Not. Dicot., 688) is the same as *J. repens*, L.

MYRTACEÆ.

44. RHODAMNIA CINEREA, Griff., (Not. Dicot., 653 et Jack.); *Rh. concolor*, Miq., (Suppl. Fl. Sumatr., 315); *Rh. Nageli*, Miq., *Rh. subtriflora*, Bl. and *Rh. Muelleri*, Bl., all belong in my opinion to *Rhod. trinervia*, Bl.

45. NELITRIS PALLESCENS, Miq., (Suppl. Fl. Sumatr., 314), is identical with *N. paniculata*, Ldl.

SAMYDACEÆ.

46. CASEARIA OVATA, Roxb., (Fl. Ind., II, 428, non Willd.) is to be retained as *C. Canziana*, Wall., (ap. Voigt. Cat. Hort. Calcutt., 78).

47. BLACKWELLIA sp., Griff., (Not. Dicot., 584, t. 585, A. f. 10,) is a new species, nearly allied to *Homalium fagifolium*, Bth., but differing from it by the flowers. The species may be called *Hom. Griffithianum*.

CUCURBITACEÆ.

48. TRICHOSANTHES RENIFORMIS, Miq.

Herba perennis, gracilis, volubilis, pubescens, cirrhis bifidis, simplicibus; folia cordato-ovata v. lato-cordata, longiuscule petiolata, breviter cuspidata v. acuminata, basi sinuata, remote repando-dentata, 3-4 poll. longa, membranacea, utrinque brevi pubescentia v. puberula; juniora subtus molliter pubescentia; flores (in alabastro) virescente albidi; masculi pedicellati in racemum brevem corymbiformem, puberulum, breve ($\frac{1}{2}$ - $\frac{2}{3}$ poll.) pedunculatum, axillarem collecti et basi pedicellorum bracteolâ minutâ caducâ instructi; feminei solitarii, pedunculis brevibus decurvis, puberulis, axillaribus; calycis lobi breves, subulati, reflexi; petala...; ovarium minute muricatum et puberulum, mox glabrescens; pepo ovali-oblonga, circ. $1\frac{1}{2}$ -2 poll. longa, laevis v. apicem versus pubera, polysperma; semina pulpa nidulantia, planiuscula, lato 4-angularia, basi in tumorem latum planum producta, medio vitta prominente longitudinali percursa et lateribus prominentibus truncatis concavisque.—Sikkim-Himalaya.

49. SCOTANTHUS TUBIFLORUS, Naud., is to be referred to *Gynopetalum Cochinchinense*, (*Bryonia Cochinchinensis*, Lour., Fl. Coch. 595).

50. *CUCUMIS INTEGRIFOLIUS*, Roxb., (Fl., III, 724)) is *Gymnopetalum integrifolium*. I refer this species to *Gymnopetalum*, but as the petals are sometimes found jagged, it might also belong to a section of *Trichosanthes* which I call *Pseudo-Trichosanthes*. This section comprises the species of *Trichosanthes* with diœcious, solitary flowers, the females, having them on very short peduncles, or almost sessile, while the males are long and slender. The difference of *Trichosanthes* and *Gymnopetalum* appears to rest almost solely in the fringed or not fringed petals, a character to which hardly a generic value can be attached.

51. *MUCKIA SCABRELLA*, Arn., must be changed into *M. Maderaspatana*, (*Cucumis Maderaspatana*, L., sp. pl. 1438—non Roxb.).

52. *ALSOMITRA HETEROSPERMA*, Rœm. (Syn. monog., II, 118) is evidently a *Gomphogyne*, (= *Zanonia heterosperma*, Wall., in Miq. Fl. Ind. Bat., I-1, 683).

BEGONIACEÆ.

53. *BEGONIA POLYCARPA*, DC., is referable to *B. Roxburghii*, DC.

54. *Begonia Brandisiana*, n. sp.

Herba succulenta, subsimplex, subglabra, radice tuberosa; folia radicalia et simul caulina, quorum caulina multo minora et brevius petiolata, vulgo 5-loba, radicalia autem petiolis glabris 5-8 poll. longis suffulta, lato rotundata, basi sinuata v. subcordata, membranacea, vulgo 5—7 poll. longa et 6—8 poll. lata, glabra v. supra pilis minutis adspersa, palmato 5-7—nervia et profunde 5-7—loba, lobis acuminatis et obsolete repando-dentatis; flores minuti, albi, pedicellis capillaribus, cymas repetito dichotomas, multifloras, pedunculo longissimo plerumque radicali instructas, formantes; bracteæ minutæ, lanceolatæ, acutæ; sepala in utraque sexu 2, lato-rotundata, emarginata, lineam tantum longa et paululum latiora; petala nulla, antheræ numerosæ; oblongæ, mucronulatæ, filamentis brevibus liberis; styli 3, apice bifidi, lobis stigmaticis spatulato-dilatatis, glandulis pedicellatis ciliatisque vestitis; capsulæ 3-4 lin. longæ, glabræ, 3-loculares, ovatæ et acutæ, subæqualiter v. æqualiter 3-alatæ, alis oblongis et retrorse productis; placentæ indivisæ.—Martaban, Attaran valley (Dr. Brandis).

55. *Begonia surculigera*, n. sp.

Herba parva, succulenta, erecta, 4—6 poll. alta, caulibus glabris v. parce glanduloso-puberulis, basi sæpius surculos parvifoliatos tenues emittentibus; folia alterna, (petiolis 3-8 lin. longis glabris), oblique cordato-ovata, acuminata, minute obsoleteque setaceo-crenato-dentata et subciliolata, 1—3 poll. longa, membranacea, supra pilis brevibus crassis adspersa, subtus glabra v. secus costam parce pilosula; flores parvi, candidi, pedicellis laevibus capillaribus suffulti, cymam axillarem dichotomam glanduloso-puberulam formantes; bracteæ numerosæ, minutæ, oblongæ, acutæ, reflexæ; sepala fl. masc. oblongo-rotundata, circ. 2 lin. longa, extus hinc inde pilis nonnullis paleaceis adspersa; petala paululum minora; stamina monadelphæ, antheræ obovatæ, mucronulatæ; styli 3, graciles, liberi v. basi cohærentes, apice concavi et dilatati, glandulis stigmaticis villosa-marginatis; capsulæ nutantes, ovales, acuminatæ, circ. 3 lin. longæ, glabræ, 3-loculares et 3-alatæ, alis semihastatis, inæquali-latis; placenta bifida.—Frequent on moist sandstone rocks, overgrown with mosses, in mixed and evergreen forests of the Akyab District, Arracan.—Fl. and fr. in Octob.

56. *Begonia modestiflora*, n. sp.

Herba erecta, simplex, glabra, radice tuberosâ, caulibus magis minusve angularibus, 1-2—pedalibus; folia alterna, valde oblique et profunde cordato-ovata, acuminata, petiolis 1—3 poll. longis glabris, palmato 7—9—nervia, 3—6 poll. longa, serrato-dentata, sæpius angulata v. sublobata, membranacea, supra lucida et pilis nonnullis brevibus crassis adspersa, subtus pallida et glabra; stipulæ subulatæ, parvæ; flores parvi, albi, pedicellis capillaribus instructi, in cymulas dichotomas graciles et vulgo foliolo lanceolato, v. lineari serrato, acuminatissimo, supportatas collecti atque paniculam terminalem elongatam, parvifoliatam, glabram, efformantes; bracteæ minutæ, lineari-lanceolatæ, vix $\frac{2}{3}$ lin. longæ; sepala oblonga, obtusa, circ. 2 lin. longa; petala angustiora et duplo minora; stamina numerosa, libera; antheræ oblongæ, mucronatæ; styli 3, liberi, (apice clavato dilatato et concavo), glandulis stigmaticis marginati; capsulæ obovatæ, semipolli-

cem circiter longæ, glabræ, 3-loculares, inæqualiter 3-alatæ, alis apice horizontaliter truncatis, basi inæqualiter et acutiuscule productis; placentæ bifidæ.—Habitu *B. scutata*, Wall.—On sandstone rocks in the beds of hill streams on Boronga island, opposite Akyab, Arracan; occurring up to 1000 feet elevation.

57. *Begonia paleacea*, n. sp.

Herba erecta, humilis, simplex v. subsimplex, succulenta, radice tuberosa, caulibus, petiolis inflorescentiaque plus minus pilis paleaceis brevibus obtectis; folia solitaria ad apicem caulis v. prolifera, oblique cordato-rotundata, s. ovata, petiolis $\frac{1}{2}$ -1 poll. longis, paleaceo-tomentosis, (nonnunquam cum caulibus confluentibus) suffulta, obtusa v. obtuse acuminata, integra v. grosse crenata, sæpe subtilissime ciliata, 3—6 poll. longa et longiora, membranacea, glabra v. nonnunquam supra, v. utrinque, papillosa, v. subtus secus nervos pilosa; stipulæ lanceolatae, acuminatæ, pilosæ; flores parvi, albi, pedicellis capillaribus glanduloso-pubescentibus, in cymas longe pedunculatas, graciles, sed paucifloras, paleaceo-pilosas, e basi costæ foliorum ortas, dispositi; bracteæ flor. masc. magnæ et conspicuæ, 4 lin. fere longæ, lato-ovatae, obtusæ, glabræ, caducissimæ, eæ florum fem. minoræ, lanceolatae, acuminatæ, pilosæ et magis persistentes; sepala lato-rotundata, circ. 2 lin. longa, extus sparse pilosa, petala paulum minora; antheræ obovatæ, emarginatæ, numerosæ, monadelphæ; styli 2, connatæ, breviter bilobæ; capsulæ circ. 5 lin. longæ, oblongæ, glabræ v. parce pilosæ, 2-loculares, 3-alatæ, alæ c. $1\frac{1}{2}$ lin. latæ et apice truncatæ, v. ala media plerumque duplo latior; placentæ bifidæ.—Martaban, Attaran valley. (Dr. Brandis).

FICOIDEÆ.

58. *TRYPHERA*, Bl.—I had some time ago identified this genus with *Mollugo Glinus*, A. Rich., which identification is also recorded by Zollinger in his "System. Verzeichniss der im Indischen Archipel gesammelten Pflanzen, 2 part, p. 141." The book has only very lately come into my hands.

UMBELLIFERÆ.

59. *Hydrocotyle Burmanica*, n. sp.

Herba repens, glabra, ramis adscendentibus; folia petiolis longis,

gracilibus, glabris, lato-cordata, 2-2½ poll. lata, (lobis subacuminatis et crenato-dentatis), membranacea, glabra, basi palmato 5-nervia ; stipulæ lato-rotundatæ, scariosæ ; flores minuti, numerosi, pedicellis filiformibus, circ. 1½-2 lin. longis, in umbellas oppositifolias, solitarias, longe pedunculatas, glabras, collecti ; fructus lato-didymi, mericarpia utrinque costâ unicâ prominente percursa.—Martaban, Daunat-toung, 3000 feet. (Dr. Brandis).

CORNACEÆ.

60. *STYRAX JAVANICUM*, Bl., (Bydr., 671,) is identical with *Marlea begoniæfolia*, Roxb.

61. *MARLEA VILLOSA*, (*Styrax villosum*, Bl., Bydr., 671 ; Miq. Fl. Ind. Bat., I-2, 464).

Arbusecula, ramulis fulvo-pubescentibus ; folia oblique lanceolata v. oblongo-lanceolata, basi acuta v. obtusiuscula, petiolis circ. 2 lin. longis, fulvo-pubescentibus, obtuse acuminata, 2—4 poll. longa, membranacea, integra, supra secus nervos puberula, subtus fulvescenti-pubescentia ; flores parvi, pedicellis 2 lin. longis suffulti, in racemos simplices subsecundos, adpresse fulvo-pubescentes, circ. ½ poll. longos, breviter pedunculatos, dispositi ; calycis limbus cyathiformis, lato 5-dentatus, unacum tubo ad basin 1-bracteolato, oblongo-cylindrico, adpresse pubescens ; corolla 5-petala, ¼ poll. longa, petalis 5-linearibus utrinque adpresse fulvo-pubescentibus ; stamina 5, filamenta fulvo-villosa, brevissima, antheris linearibus multoties breviora.—Cult. in Hort. Bogoriensi.

62. *Styrax rugosum*, n. sp.

Arbusecula ?, ramulis novellisque ferrugineo-floccoso tomentosis ; folia oblonga, petiolis ½ lin. longis, crassis, floccoso-tomentosis, basi obtusa, magis minusve acuminata, irregulariter serrata et nonnunquam sublobata, 1½-2½ poll. longa, supra rugosa et puberula, subtus molliter albescente-tomentosa ; flores mediocres, albi, pedunculis curvis crassis circ. 1 lin. longis, floccoso-tomentosis, suffulti, solitarii, axillares, et versus novellorum ramorum apicem racemum spurium foliatum formantes ; bracteæ calycis longitudine, lineari-subulatæ ; calyx albescenti-tomentellus, lateribus magis minusve ferrugineo-floccosus, vulgo spathaceus et

usque ad mediam partem fixus, irregulariter 5-dentatus, dentibus lineari-subulatis ; corolla circ. $\frac{3}{4}$ poll. longa, velutina, lobis oblongis obtusiusculis ; filamenta ad basin latam albido-villosa.—Pegu, hills between Sittang and Salween, at 4000 feet elevation. (Dr. Brandis).

LORANTHACEÆ.

63. *LORANTHUS RACEMIFERUS*, Wall. ap. DC. (Prod., IV, 296) = *L. coccineus*, Jack.

Lor. pallens, Wall. ap. DC. (l. c., 297) = *L. sphaerocarpus*, Bl.

Lor. carinatus, Wall. ap. DC. (l. c., 296) = *L. ampullaceus*, Roxb.

Lor. leptanthus, Wall. ap. DC. (l. c., 299) = *L. pulverulentus*, Wall.

Lor. rigidus, Wall. ap. DC. (l. c., 298) and *farinosus*, Desr. (DC. l. c.) are both the same as *L. pentandrus*, L.

64. *Loranthus Siamensis*, n. sp.

Frutex parasiticus, ramis teretibus, junioribus novellisq[ue] ferrugineo-farinoso tomentellis, adultis lenticellis, corticosis, ferrugineis adpersis ; folia opposita v. subopposita, ovata, basi subcordata v. rotundata, breviter (2-3 lin.) petiolata, obtuse acuminata v. apiculata, rarius subobtusata, integra, crassissime coriacea et præter costam obsoletam subavenia, juniora ferrugineo-farinoso, adulta magis minusve glabrata v. glabra, 2-3 poll. longa ; flores.... sessiles, spicas solitarias, v. binas, $1\frac{1}{2}$ -2 poll. longas, dense ferrugineo-tomentosas, axillares formantes ; bracteæ solitariæ, magnæ, ovario triplo longiores, elliptico-oblongæ, tomentosæ ; calyx dense ferrugineo-tomentosus, limbo obsolete truncato ; corolla extus tomento cum furfure mixto ochraceo v. ferrugineo induta, intus testaceo-tomentella, limbo 5-partito ? ; baccæ pisi minoris magnitudine, urceolato-ovatae, densissime fulvo v. subferrugineo tomentellæ, truncatae, bracteâ æquilongâ sustentæ.—Siam, Búkit Kethay, Kán-búri (Teysmann Herb. Bog. 6001.)—Near *L. tomentosus*, Heyne.

65. *Loranthus rhapalocarpus*, Kurz, (*Lor. cuneatus*, Wall. ap. DC., Prod., IV, 301, non Heyne).

Fruticulus densus parasiticus ramosissimus, 1-2 ped. altus, omnibus fere partibus subtiliter floccoso-lepidoto tomentellis ;

folia parva, opposita v. alterna, obovato v. oblongo-cuneata, in petiolum brevem attenuata v. quandoque subsessilia, apice rotundata, integra, coriacea, nervis tenuibus per-cursa, $1-1\frac{1}{2}$, raro 2 poll. longa, dum juvenilia utrinque, subinde subtus tantum tenuiter furfuraceo-velutina v. glabrescentia; flores albidii, $\frac{1}{2}-\frac{3}{4}$ poll. longi, dense testaceo-velutini et sublepidoti, pedicellis $1-1\frac{1}{4}$ lin. longis, in cymulas 2-5—floras, testaceo-velutinas subsessiles, v. breviter pedunculatas, axillares dispositi; bracteæ solitariae, minutæ, subcucullatæ; calycis tubus cylindrico-oblongus, dense testaceo-velutinus, limbus truncatus et paulum incrassatus; corollæ tubus gracilis, curvulus, extus dense furfuraceo-tomentosus, limbus 4-fidus; stamina 4, antheræ oblongæ; baccæ (adhuc immatura) elongatæ, lineari-cuneatæ, circ. $\frac{1}{2}$ poll. longæ, tenuiter testaceo v. ferrugineo-velutinæ, basi supra bracteâ minutâ annulato-marginatæ.—Frequent in Arracan, as in Koladyne District, especially on *Lagerstræmia*.

A. Pyr. de Candolle appears to have made a curious mistake in describing the linear club-shaped berries for a corolla, and in taking the elongate seed for a club-shaped style and anthers. No wonder, therefore, when he says: Antheræ forte 5, sed in floribus junioribus (= baccis immaturis) obscuræ, glutine viscoso inter se et cum stigmate concretæ. He evidently mistook also the short space between the annular thickening at the base of the berries and the bract for an ovary.

66. *Loranthus Brandisianus*, n. sp.

Frutex parasiticus glaber; folia opposita s. subopposita, lanceolata ad elliptico-lanceolata, basi acuminata, (petiolis $\frac{1}{3}$ ad $\frac{1}{2}$ poll. longis crassis), longe acuminata, integra, crasse coriacea, (nervis lateralibus vix visibilibus), glabra, subtus pallida, sed non glauca; flores glabri, circ. pollic. longi v. paululum longiores, pedicellis $2-2\frac{1}{2}$ lin. longis glabris, racemos cymosos pauciflores solitarios v. geminatos glabros axillares formantes; bractea bracteolæque laterales ovatæ, acutæ, basi connatæ; alabastra 6-angulata; calyx glabra, tubus elliptico-oblongus, limbus truncatus; corolla glabra, circ. poll. longa, tubus a basi modice inflatus et urceolato-tubulosus, limbus profunde 6-fidus, lobis linearibus acutis, reflexis, fere tubi longitudinis; stamina 6, antheræ

lineares ; stylus filamentaque glaberrima ; baccæ...—Karen-hills E. of Tounghoo, on Taipo mountains, at 3000 feet elevation. (Dr. Brandis).

67. *Loranthus eleutheropetalus*, n. sp.

Frutex parasiticus, glaberrimus ; folia opposita v. subopposita, lanceolata ad elliptica et lineari-lanceolata, obtusa v. magis minusve obtuse acuminata, basi in petiolum $\frac{1}{3}$ - $\frac{1}{2}$ poll. longum attenuata, integra, crasse coriacea et enervia, glabra, viridia ; flores (coccinei ?), glabri, c. $1\frac{1}{2}$ poll. longi, pedicellis 2-2 $\frac{1}{2}$ lin. longis, patentibus, in racemos terminales et axillares laxissimos elongatos, sæpe 3-4 poll. longos, minute puberulos, mox glabrescentes, dispositi ; bractea lato cucullato-oblonga, obliqua, parviuscula ; bracteolæ nullæ ; calyx subtilissime puberulus, mox glabrescens, tubo cylindrico 2-2 $\frac{1}{2}$ lin. longo, limbo truncato ; corolla 6-petala, petalis in alabastro coherentibus dein liberis, anguste linearibus, $1\frac{1}{3}$ poll. longis, erecto-patentibus et supra basin reflexis ; filamenta et stylus angulatus glabri ; antheræ elongato-linearæ, acuminatæ.—Pym Kyoung (Pywoon Choung ? in Pegu ? or in Martaban ?). (Dr. Brandis).

68. *VISCUM HELFERI*, Prsl. (Epim. Bot. 256) is *Ginallia Helferi*. The species of the genus *Ginallia* appear to have all a curious sheath-like thickening at the base of each joint, by which they are easily recognised. *G. spathulifolia*, Oliv. (*V. spathulifolium*, Thw.) appears to differ from *G. Helferi* only by narrower 3-nerved leaves. Another species of *Ginallia* will be the *Viscum* from the Andamans, which I have incorrectly compared with *V. heteranthum*, Wall. Wallich's species is referred by Meissner to *Henslowia*.

69. *VISCUM MONILIFORME*, WA. (Prod., I, 380, non Bl. ; Wight Icon., t. 1018 et 1019). This species is (to judge from the citations of Wight's figures) referred by Mr. Bentham to *V. articulatum*, Burm., but I think the two differ from each other in structure, as well as in general habit.

V. articulatum, Burm. Articles slightly narrowed at the joints and not conspicuously dilated, longitudinally ribbed, each article placed at a right angle with the other and, therefore, decussately crossing each other, but twisted so as to appear in one plane. Those of the main branches, however, are in one plane as in the following.

V. moniliforme, Wight. Articles all in one plain and complanate, without any other rib but the median one, at their truncate joints dilated in a complanate cup, in which the flowers rest.

To the former (*V. articulatum*) belong also *Viscum moniliforme*, Bl., *V. elongatum*, Wall., *V. fragile*, Wall., *V. attenuatum*, DC., and *V. aphyllum*, Griff., (Not, Dicot. 634 t. 630).

SYMPLOCACEÆ.

70. *SYMPLOCOS ATTENUATA*, Wall., ap. DC. (Prod., VIII, 256) = *S. polycarpa*, Wall., ap. DC. (loc. cit.).—*S. Hamiltoniana*, Wall., DC. (loc. cit.) is *S. racemosa*, Roxb.—*S. iteophylla*, Miq. = *S. adenophylla*, Wall., ap. DC.—*S. Horsfieldiana*, Miq., in Suppl. Fl. Sumatr., 475, *S. rubiginosa*, Wall. ap. DC. and *S. ferruginea*, Roxb., are all to be referred to *S. Javanica* (*Dicalyx Javanicus*, Bl. 1, Bydr., 1117).

71. *Symplocos sulcata*, n. sp.

Arbuscula novellis adpresse ferrugineo v. fulvescente pubescentibus; folia lanceolata ad elliptico-lanceolata; basi acuta, (petiolis 3-4 lin. longis crassis), acuminata, magis minusve crenato-serrulata v. integra, crasse chartacea, 5—7 poll. longa, supra lucida, glabra, subtus valide nervosa et laxè reticulata; flores parvi, lutei, subsessiles, in racemum simplicem ferrugineo-tomentosum, brevem, axillarem, collecti; bracteæ bracteolæque subæquales, obovato-lanceolatae, acutæ, adpresse pubescentes, lineam fere longæ; calyx dense adpresse pubescens, lobis circ. lin. longis, ovato-lanceolatis, obtusiusculis; stamina numerosa, inæqualia, basi inserta; drupæ elliptico-oblongæ, pedicellis brevissimis, ($\frac{1}{3}$ lin. long.), tomentosis, circ. 4-5 lin. longæ, sulcatae, subglabræ, cyanescente-nigræ, calycis limbo coronatæ, putamen sulcatum durum 3-locularem includentes; embryo rectus.—Martaban, Dautnat pass, 4000 feet (Dr. Brandis). This species will range along with *S. racemosa*.

The genus *Symplocos*, the species of which are supposed to be very difficultly to distinguish, might perhaps be divided in the following way:—

Subg. 1. *Alstonia*, DC.—Corollar-lobes twice as many as calyx-lobes, in 2 rows (American).

Subg. 2. *Hoepa*, DC.—Corollar-lobes as many as calyx-lobes, in a single row.

* Ovary 3-celled. Drupes oblong to elliptical, 3-celled. Embryo straight.

** Ovary 2, rarely 3-celled. Drupes ovoid and contracted at top or turbinate, by abortion usually 1-seeded, often the mass of the endocarp protruding inwards so as to cause the seed (as in *MENISPERMACEÆ*) to be more or less horse-shoe-shaped. Embryo curved.

MYRSINEACEÆ.

72. *MÆSA GLABRA*, Roxb. and *M. Sumatrana*, Scheff., (Comment. Myrsin. 15), are both referable to *M. ramentacea*, Roxb.

73. *Mæsa permollis*, n. sp.

Fruticulus subsimplex 6-10 ped., altus, ferrugineo molli-pubescent; folia ampla, lato oblonga v. lato-elliptica, (petiolis $\frac{1}{2}$ -1 poll. longis, dense ferrugineo-pubescentibus), breviter et tenuiter acuminata, 6-8 poll. longa, sinuato-dentata, crasse membranacea, supra sparse et inconspicue, subtus molliter, pubescentia, nervis validis in denticula callosa excurrentibus percursa; flores albi, minuti, 5-meri, pedicellis brevissimis, breviter racemosi v. subfasciculati v. in paniculam contractam dense ferrugineo-tomentosam, axillarem, petiolo brevior, contracti; bracteæ minutæ, pedicellis breviores; calyx pedicellis longior, dense ferrugineo-pubescent, lobis ovatis acutis; corolla tubuloso-campanulata, glabra, calyce circiter duplo longior, lobis brevissimis, rotundatis, quorum 4 patentes, quinto superiori inclinato, ovarium subinferior; stylus brevis atque crassus, stigmate indistincte lobato coronatus.—Martaban, Thoungyeen. (Dr. Brandis).

74. *Embelia sessiliflora*, n. sp.

Frutex scandens ramulis brunneis lævibus, novellis minute puberulis; folia ovato-oblonga ad oblonga, obtusiuscule apiculata, (petiolis 2 lin. longis, calloso-subdentatis), pergamacea, integra, 2-4 poll. longa, glabra, nervis etc. uti in *E. Ribes*; flores minuti, albi, sessiles v. subsessiles, basi bracteâ lineari-subulatâ puberula, floris totius v. calycis longitudine supportata, in spicas graciles paniculatas, axillares et terminales

conescenti-velutinas dispositi ; calyx puberulus, lobis triangularibus acutis ; petala crassa, minute puberula, oblonga, obtusiuscula, lineam fere longa ; stamina petalis breviora, filamenta crassa, puberula, antherarum longitudine.—Pegu (Karen hills ?), (Dr. Brandis).

This species agrees in many respects with *E. Ribes*, Burm., but differs from it by the sessile or nearly sessile flowers.

75. *EMBELIA GARCINLÆFOLIA*, Miq., (Pl. Jungh., 187 ; Scheff Comm. Myrs., 40,) is *E. floribunda*, Wall.

E. picta, Wall. ap. DC. does not differ from *E. robusta*, Roxb.

E. ferruginea, Wall. ap. DC. is hardly different from *E. villosa*, Wall., a species so nearly allied to *E. robusta*, Roxb., as to make it not improbable that both are only varieties of one and the same species.

76. *MYRSINE MYRTILLUS*, Hook., (Icon. Pl., t. 825 ; Walp. Ann. V, 473), is evidently an *Embelia*.

77. *Ardisia Brandisiana*, n. sp.

Frutex v. suffrutex ? ramis crassiusculis et succulentis, indistincte lepidotulis ; folia oblonga v. elliptico-oblonga, petiolis $\frac{2}{3}$ ad poll. longis, crassis, basi inæqualia et acuta, obtusa, 5-6 poll. longa, undulato-repanda, pergamacea, glabra, nervis lateralibus tenuibus et parallelo-curvis, vix visibilibus, percursa ; flores conspicui, pedicellis pollicaribus, minute puberulis, sursum incrassatis, racemum umbelliformem axillarem, pedunculo 3-4 poll. longo, nudo, instructum, formantes ; calyx subglaber, lobis circ. 2 lin. longis, ovato-oblongis, acutis, membranaceis ; corollæ lobi sepalis plusquam duplo longiores, ovati, acuminati.—Burma, along a choung near Toubmjetseik (?) growing up to an elevation of nearly 50 feet, Salween. (Dr. Brandis).

78. *ARDISIA POLYSTICTA*, Miq., (Suppl. Fl. Sumatr., I, 576 ; Scheff. Comm. Myrs., 75) which Dr. Scheffer declares to be well distinguishable from *A. crispa* DC., by the compound inflorescences and rather long peduncled umbels, is nothing but one of those frequent forms of *A. crispa*, which have the peduncles growing out into additional peduncled umbels, as is for inst. clearly shown in Bot. Reg. t. 533, sub *A. lentiginosa*.

79. *Ardisia involucrata*, n. sp.

Frutex glaber, habitu *A. humilis*; folia obovata ad obovato-lanceolata, basi in petiolum brevissimum attenuata, breviter acuminata v. subapiculata, 4-5 poll. longa, pergamacea, glabra, nervis lateralibus tenuibus, iis *A. humilis* persimilibus percursa; flores majusculi, cereacei, intense rosei v. purpurei, pedicellis crassis $\frac{1}{2}$ -1 poll. longis, dein elongatis, suffulti, racemos umbelliformes glabros, pedicellorum basi involucratos, longiuscule pedunculatos, axillares v. subterminales formantes; involucri bracteae conspicuae, purpureae v. roseae, pedicellorum longitudine, ovato-oblongae, acutiusculae; calycis glabri laciniae ovales, circ. 4 lin. longae, dein paulum accrescentes; baccæ globosae, calycis laciniiis auctis multoties breviores. —Not unfrequent in the forests of the outer hills of Sikkim Himalaya, especially between Khersiong and Punkabarri, in Balasun valley etc., at 1—4000 feet elevation; also descending occasionally into the Terai.

80. CLIMACANDRA OBOVATA, Miq., will have to be changed into *Cl. littoralis* (*Ardisia littoralis*, Andr. Repos. X, 630). De Candolle merges *A. littoralis* into *A. humilis*, but I think incorrectly.

Ardisia multiflora, Miq. and *Ardisia umbellata*, Roxb., (Fl. Ind., I, 582) belong both to the above.

81. AEGICERAS MAJUS, Gäertn., is *Aeg. corniculata*, Blanco, (Fl. Filip., 70, *Rhizophora corniculata*, L.).

SAPOTACEÆ.

82. The Indian genera of SAPOTACEÆ might be arranged as follows:—

* Calycis et corollæ lobi isomeri.

(1.) *Chrysophyllum*. Flores 5-8-meri. Stamina 5-8. Staminodia nulla. Ovarii loculi 5-8.

(2.) *Sideroxylon*. Flores 5-meri. Staminodia 5. Ovarii loculi 5-2.

(3.) *Achras*. Flores 6-meri. Stamina 6. Staminodia 6. Ovarii loculi 12.

(4.) *Isonandra*. Flores 4- s. 6-meri. Stamina lobis duplo pluria, uniseriata. Staminodia nulla. Ovarii loculi calycis lobis isomeri.

** Calycis et corollæ lobi anisomeri. Ovarii loculi tot quot calycis lobi.

(5.) *Payena*. Calycis lobi 4 s. 6 ; corollæ lobi duplo plures. Stamina corollæ lobis duplo pluria, biseriata. Staminodia nulla.

(6.) *Bassia*. Calycis lobi 4 s. 6 ; corollæ lobi 8—14. Stamina corollæ lobis circiter duplo v. triplo pluria, 1—3-seriata: Staminodia nulla.

(7.) *Mimusops*. Calycis lobi 6 v. 8 ; corollæ lobi 2-3-plo plures. Stamina tot quot calycis lobi. Staminodia 6 v. 8.

83. CHRYSOPHYLLUM SUMATRANUM, Miq., (Suppl. Fl. Sumatr. 579) = *Ch. Roxburghii*, G. Don.

84. SAPOTA ? TOMENTOSA, DC., is in my opinion a true *Sideroxylon*.

85. SIDEROXYLON OBOVATUM, Griff., (Not. Dicot., 290) is *S. attenuatum*, DC.

86. KAKOSMANTHUS, Hassk., cannot be separated from *Bassia*, and *Dosyaulus*, Thw., has also been identified with the latter genus by the author himself.

87. Dr. Thwaites pronounced *Isonandra* to be a *Bassia*, but from the conspectus of the genera above given, that genus appears to me to be well founded.

Bassia caloneura, Kurz, (in Andam. Rep., p. 41) with chartaceous strongly nerved leaves and 4-lobed calyx is now referable to *Isonandra*.

Bassia ? hypoleuca Miq., (Suppl. Fl. Sum., 582) = *Isonandra obovata*, Griff., (Not. Dicot., 293).

Bassia polyantha, Wall. ap. DC. is also an *Isonandra*.

88. CERATOPHORUS WIGHTII, Hassk. (Retz., I, 601) is *Payena lucida*, DC. DeCandolle mistook the filaments of the fallen anthers for staminodia, and hence the discrepancy in the number of stamens. The genus might be divided thus :

Sect. 1. *Hexameria*. Calyx 6-partitus ; corollæ lobi et stamina calycis lobis duplo pluria. (*P. Griffithii*).

Sect. 2. *Payena*. Calyx 4-partitus ; corollæ lobi et stamina calycis lobis duplo pluria.

* Antheræ pilosæ, (= *Ceratophorus*, Hassk.), *P. Leerii*, (*Ceratoph. Leerii*, Hassk.) et *P. longipetiolata* (*Ceratophorus longipetiolatus*, T. et B.)

** Antheræ glabræ (*Payena*, DC.), (*P. lucida*, *P. paralleloneura*).

89. *Payena paralleloneura*, n. sp.

Arbor ingens, ramulis subtiliter ferrugineo-puberis ; folia elliptica ad elliptico-lanceolata, petiolis circ. poll. longis, gracilibus, glabrescentibus, suffulta, breviter acuminata, 3-4 poll. longa, tenui corvacea, glabra, nervis lateralibus tenuibus parallelis sub angulo fere recto divergentibus ; flores mediocres, albi, pedunculis circ. poll. longis, minute fulvescente-puberis suffulti, 3—7-ni fasciculati ; fasciculi axillares, petioli longitudine v. paulum longiores ; calyx minute fulvescente-puberus, 4-partitus, sepalis lato-ovatis, acutis, circ. 3 lin. longis ; corolla glaberrima, lobis elliptico-oblongis obtusis ; stamina 16, antheris glabris, aristato-mucronatis ; ovarium fulvescente pubescens ; baccæ ovatæ, pruni magnitudine, apiculatæ, glabræ, 1- raro 2- spermæ.—Pegu. Differs from *P. lucida* by the acute sepals, the bristly-terminated (not beaked) anthers, by the longer petiols and by the nervature of the leaves.

90. *MIMUSOPS INDICA*, (Kurz, in And. Rep. 42, et DC. quoad specim. *Martabanica*).

This is the well-known Andaman bullet-wood, but there are considerable difficulties in giving the tree a proper scientific name. Mr. Bentham has identified it with his *M. Browniana*. The description of the fruit and seed of the Australian *M. Browniana* appears to me to differ considerably from the Andaman species. In the former the fruit is said to be ovoid or almost globular and 1-2 seeded, while in the latter it is decidedly depressed globular (not unlike in shape and size to a wood-apple), 5-6 seeded, and the hilum hardly half the length of the seed. I have unfortunately no specimens from Ceylon, and therefore I am unable to compare my plant with *M. Kauki* L. Bentham, who has seen the Linnean specimens of *M. Kauki*, declares them to be *M. Indica*, &c., (Wight Icon., t. 1587), a common species all over Hindustan. The very short Linnean description, however, represents more the Andaman tree with solitary flowers than the Hindustan tree, which latter is the same as *M. hexandra*, Houb., Corom., Pl. I, 16, t. 15, differing from the former considerably by the 1-seeded, differently shaped, fruits and by the flowers being always two or more together in the axils of the leaves.

M. Kauki, Houb., and Miq. Fl. Ind. Bat., II, 1042, is undoubtedly *M. Bojeri*, &c. (? = *M. dissecta*, Hook. Bot. Mag., t. 3157).

M. Roxburghiana, Wight, Icon., t. 1588 (excl. synonym. Roxb.) is a species unknown to me; it differs from all those above named by the very slender peduncles, larger flowers and by the shape of the staminodial scales.

Imbricaria, Comm., is not generically different from *Minusops*.

EBENACEÆ.

91. *Diospyros rhodocalyx*, n. sp.

Arbuscula novellis adpresse pubescentibus; folia oblonga v. ovali-oblonga, rarius obovato-oblonga, retusa v. rarius (in eodem stirpe) obtuse apiculata, graciliter et breviter petiolata, basi acuta v. obtusa, chartacea, magnitudine variabilia, 1—2 v. 3—4 poll. longa, supra glabra et lucida, subtus secus costam plerumque parce pubescentia, nervis et reticulatione laxa utrinque conspicuis; flores 4—meri, parvi, sessiles v. subsessiles, axillares, masculi cymulas brevissimas tomentosas formantes, feminei solitarii; bracteæ lineares, dense fulvo-tomentosæ, breves; calyx dense fulvescenti pubescens, lobis oblongo lanceolatis, obtusiusculis, in floribus femin. major, lobis lato-oblongis, obtusis, basi marginibus plicato-dilatatis, rubro-tinctis; corolla glabra, in masc. vix 2 lin., in femin. 3 lin. fere longa, tubo bullato, lobis 4 brevibus, oblongis; stamina in fl. masc. c. 16, in fem. 8—10, ima basi corollæ inserta; filamenta brevia, barbata; antheræ lineares, acuminatæ; ovarium in masc. rudimentarium, in fem. oblongum, dense fulvo tomentosum, 4-loculare? Siam, Rádbúrí and Kánbúrí (Teysm. in Herb. Bog. No. 6000 and 6007).

In general habit somewhat resembling *D. heterophylla*, Wall., and best placed near *D. tomentosa*, etc., in sect. III, amongst the four-merous species.

92. *Diospyros dasyphylla*, n. sp.

Arbor? ramulis dense fulvescente pubescentibus; folia oblonga ad ovato oblonga, petiolis 1—2 lin. longis, dense fulvo pubescentibus, suffulta, basi rotundata v. subcordata, acuta v. brevissime acuminata, 4—6 poll. longa, chartacea, dum juvenilia longe ciliata, dein subtus et supra secus nervos molliter puberula; flores in alabastro fere 4/5 poll. longi, 4-meri, breviter pedicellati, masculi in cymas breves fulvo-

pubescentes, axillares, v. supra foliorum delapsorum cicatricibus erumpentes, dispositi; bracteae suborbiculares, puberulae, ciliatae, lineam circiter longae; calyx ferrugineo-pubescent, usque ad basin fere partitus, lobis rotundatis, obtusis, ciliatis; corollae tubus adpresse fulvo v. ferrugineo-pubescent, 3 lin. circiter longus, tubulosus et paulo ampliatus; lobi tubi longitudine, oblongi, acuti, extus canescente velutini; stamina in masc. circiter 16, basi corollae inserta, filamenta valde inaequalia, nonnulla 1—2 lin. longa, pluria brevissima; antherae oblongae, acutae; ovarii rudimentum fl. masc. fulvo hirsutum; flores feminei et baccae ignotae.—Karen hills, Taipo mountains, at 4000 ft. elevation, (Dr. Brandis).

Near *D. densiflora*, Wall.

93. *Diospyros Brandisiana*, n. sp.

Arbor novellis breviter pubescentibus; folia iis *D. chartaceae* per similia, petiolis 1—2 lin. longis, puberulis, suffulta, oblonga ad elliptico-oblonga et oblongo-lanceolata, acuminata, basi rotundata v. acuta, chartacea, 4—6—8 poll. longa, adulta glabra v. plerumque secus costas sparse adpresse hirsuta; flores in alabastro 4—5 lin. longi, 5-meri, pedicellis 1—2 lin. longis, subinde elongatis, tomentosis, suffulti, in cymas densiusculas, ramosissimas, minute bracteatas, nigrescenti-brunneas, tomentosas, e ramis ortas v. axillares, dispositi; bracteae minutae, oblongo-lanceolatae, tomentosae; calyx nigrescent v. atro-brunneo tomentellus, lineam circiter longus, 5-fidus, lobis lineari-lanceolatis, acutis; corollae adpresse pubescentis tubus $2\frac{1}{2}$ lin. longus, basin versus subampliatus et vulgo 5-angularis; lobi tubi longitudine, oblongi, obtusi; stamina in masc. circa 16, in fem. ad 5 rudimentaria redacta; filamenta brevissima, pubescentia; antherae lineares, mucronatae, glabrae; ovarium in fl. fem. dense fulvo pubescent, stylo longiusculo, simplice, crasso, terminatum, 10-loculare; baccae valde immaturae ovatae, acuminatae, brevi-pubescentes. Burma, Dondamee Forests. (Dr. Bandis).

94. *DIOSPYROS OLEIFOLIA*, Wall. ap. DC., Prod. VIII, 239. (nomen nudum).

Arbor mediocris, glabra; folia elliptica ad oblongo-lanceolata, obtuse acuminata, petiolis 2—3 lin. longis suffulta, 3—5 poll. longa, subcoriacea, utrinque laevia et nitida, nervis subtilissimis

impressis et inconspicuis percursa; flores parviusculi, albi, 4-meri, breviter pedicellati, vulgo terni, pedunculis 3—6 lin. longis, subtiliter pubescentibus, axillaribus, suffulti; calyx 3 lin. fere longus, extus glaber, intus dense fulvo-tomentosus, lobis latis acutis; corolla calyx plus quam duplo longior, extus fulvo-tomentosa, tubo amplo et inflato, c. 3-3½ lin. longo, lobis brevibus rotundatis; stamina in fl. masc. c. 20 ina basi corollæ et toro inserta; filamenta inconspicua; antheræ lineares, acuminatæ, c. 2. lin. longæ; ovarii rudimentum fl. masc. minutum, fulvo-pubescentibus; fl. feminei et baccæ ignotæ.—Pegu, (Dr. Brandis), and Java, Wynkoopers Baay (Teysmann). Kayú áráng, Mal.

95. *Diospyros variegata*, n. sp.

Arbor mediocris, glaberrima; folia elliptico oblonga ad oblonga, sæpius basi sub-inæqualia, petiolis 2—4 lin. longis, crassis, suffulta, acuta ad acuminata, integra, 5—8 poll. longa, chartacea, glabra, nervis subtus prominentibus et reticulatione laxa et conspicua percursa; flores parvi, lutei, 4-meri, in alabastro 4—5 lin. longi, elongati, brevissime pedicellati, terni v. pauci, in cymas axillares breviter petiolatas, minute puberulas, bracteatas, dispositi, et secus ramulos novellos, sæpius adhuc aphyllous, racemum spurium formantes; bractæ latæ, acutiusculæ, puberulæ; calyx puberulus, lobis lato-oblongis, obtusis, c. 2 lin. longis; corolla urceolata, tubus calyx paulum longior, lobis ovatis acutis, tubi longitudine; stamina in fl. masc. c. 16, inæqualia, basi corollæ tubi inserta; filamenta brevissima; antheræ lineares, basi cordatæ, acuminatæ, glabræ; fl. feminei et baccæ ignotæ.—Pegu (Dr. Brandis).

96. *Diospyros Burmanica*, n. sp.

Arbor novellis adpresse fulvo-pubescentibus; folia elliptica ad elliptico-oblonga, petiolis 1-1½ poll. longis, puberulis, suffulta, obtusiuscula, breviter acuminata v. obtusa, integra, magis minusve 2½-4 poll. longa, juniora supra tomento tenui fugaci adspersa, dein glabrescentia, subtus dense fulvo-puberula, nervis reticulatione tenui percursa; flores feminei 5-meri, parviusculi, dense fulvo-tomentosi, solitarii pedunculis dense tomentosis, 2—3 lin. longis,

secus ramulos novellos efoliatos, dense fulvo-mentosos, suffulti et sæpius racemos laxos spurios efformantes; flores masc. ignoti; calyx dense fulvo-tomentosus, 3 lin. fere longus, lobis lato-cordato-ovatis, acutiusculis, marginibus recurvis; corolla dense et adpresse fulvo-pubescent, intus glabra, tubo brevi, loborum longitudine; stamina ad 8 redacta, basi corollæ tubi inserta; antheræ lineari-oblongæ, acutæ; ovarium ovatum, dense fulvo-pubescent, in stylum brevem crassum attenuatum; stigmata 2, crassa, 2-loba; baccæ poll. circiter crassæ, globosæ, vulgo 4-spermæ, glabræ, calyce aucto sustentæ.—Pegu (Dr. Brandis).

97. MARCREIGHTIA ANDAMANICA, Kurz, (in Rep. Veget. Andam., ed. 2, p. 42) is the female plant of *Maba Sumatrana*, Miq., with somewhat larger and thinner leaves.

ACANTHACEÆ.

98. LIMNOPHILA DIFFUSA, Roxb. (Fl. Ind., III, 93) is *Ebermaiera diffusa*.—*Ebermaiera thyrsoides*, N. E., and *E. Zeylanica*, N. E., both belong to the above noted species.

99. NOMAPHILA STRICTA, N. E., and *N. corymbosa*, Bl., will have to be named *Nomaphila pubescens*, (*Justicia pubescens*, Lamk. Ill., I, 40).—*N. Parishii*, T. And., is hardly more but one of those glandular-pubescent states of *N. pubescens*, which also occur in the more cultivated parts of Java.

100. HEMIAGRAPHIS HIRSUTA, T. And. (*Ruellia hirsuta*, N. E., in Dr. Brod., XI, 148; *Justicia hirsuta*, Vhl., Symb., II, 3, et Enum., I, 122), is in my opinion the very same plant as *Ruellia Blumeana*, N. E. in DC., I, c. 149, and therefore the latter a synonym. Dr. Anderson's *H. confinis* (*R. confinis*, N. E. in DC. I. c. 148) is another synonym, if his identification is correct, what I do not doubt. *H. hirsuta* is a very common plant in the Indian Archipelago, growing not only in moist sunny places, but also in the densest shade of village-bushes and evergreen forests. It resembles to a certain degree *Strobilanthes glaucescens*.

The differences between *Strobilanthes* and *Hemiographis* do not appear to me to be clearly defined, for the number of seeds is not very reliable, and several species of *Strobilanthes*, as for instance *St. flava*, with 8-seeded capsules, should then be referred to *Hemia-*

graphis, while another new species *St. phyllostachya*, presently to be described, would remain in *Strobilanthes*, although so nearly allied to *S. flava*, as hardly to admit separation.

101. *Strobilanthes phyllostachya*, n. sp.

Herba perennis, ramosa, 2—3-pedalis, ramis magis minusve glanduloso-hirsutis et glabrescentibus; folia oblonga ad lato-lanceolata, petiolis 2-2½ poll. longis, gracilibus, hirsutis, suffulta, breviter acuminata, basi acuta, crenato-dentata, rigidiuscula, 5—7 poll. longa, utrinque v. supra tantum pilis longiusculis, e cono minuto ortis, rigidis, hirsuta; flores conspicui, aurei, in spicas dense bracteatas, longe pedunculatas, dispositi et paniculam brachiatam glandulo-hirsutam, foliosam, axillarem et terminalem, formantes; folia floralia inferiora foliis caulinis conformia sed minora, superiora bracteiformia, lanceolata, serrata, hirsuta; bracteæ lanceolatae, acuminatae, decussatae, membranaceae, integrae, poll. longae v. longiores, glanduloso-pilosae, albidæ, apice et nervis viridibus; bracteolæ lineares, pilosae et glanduloso-pubescentes; calycis segmenta inæqualiter longa, bracteolis conformia; corolla 1½ poll. fere longa, (tubo brevi sed gracili), extus glabra, intus præcipue fauce et secus filamentorum insertionem pilosa; capsulæ glabræ, 4-spermæ.—Pegu (Dr. Brandis).

102. *STROBILANTHES SUMATRANA*, Miq. (Fl. Ind., Bat., II, 802)
= *S. pentstemonoides*, T. And.

103. *JUSTICIA ECBOLIUM*, L.

I agree with Nees v. Esenbeck, that this species deserves to be retained as a distinct genus. Dr. Anderson has placed it in *Eranthemum*, but it stands there in a very isolated position, differing from all the other species of the genus. The large bracts, 1-seeded capsules and differently shaped corollas appear to me sufficient characters for the genus, which I now propose to call *Ecbolium*. The Neesian character under his genus *Justicia* is a very accurate account of it, so that I have nothing to add to it. Wight figures 2 ovules to each cell, but I cannot confirm this point, as I have no fresh flowering specimens. The species might be called *Ecbol. Linneanum*, including the long series of synonyms mentioned already by Dr. Anderson.

VERBENACEÆ.

104. *Sphenodesma eryciboides*, n. sp.

Frutex scandens ; folia oblonga-lanceolata, acuta, petiolis brevibus, gracilibus, puberulis, suffulta, basi acuta, integra, membranacea, supra glabra, subtus palida et tenuiter pubescentia ; flores parviusculi, sed conspicui, nivei, glomerati, racemos axillares formantes et involucri minuto 6-phylo sustenti ; involucri phylla inæqualia, spatulato-lanceolata, tomentosa, calycibus 5—6-dentatis, albidis, extus dense tomentosis, intus dense sericeis, breviora ; corollæ limbus 5—6-lobus, lobis oblongis, obtusis, pubescentibus ; antheræ 5—6, minutæ ; capsulæ calyce tumido inclusæ.—Pegu (Dr. Brandis).

SCROPHULARIACEÆ.

OPHIORRHIZIPHYLLON, n. gen.

Calyx 5-fidus, laciniis subulatis. Corolla sub-bilabiata, breviter tubulosa ; tubus leviter curvus, sursum inflatus ; labium exterius brevius, 3-lobulatum, interius 2-lobulatum, lobulis omnibus rotundatis, obtusis. Stamina fertilia 2, tubo corollæ intus piloso-annulato inserta, longissime exserta ; filamenta deflexa, corolla fere duplo longiora ; antheræ 2-loculares, loculis discretis. Ovarium 2-loculare, ovulis plurimis axi centrali biseriatim inserta ; stylus filiformis, staminum longitudine, longissime exsertus, apice breviter bilobus, lobis reflexis. Capsula oblonga, acutiuscula, sepalorum longitudine, bisulca, 2-ocularis et 2-valvis.—Herba foliis oppositis, floribus racemosis albidis v. rosellis.

The position of the genus is between *Pterostigma* and *Stemodia*.

105. *O. macrobotryum*, n. sp.

Herba 2—3-pedalis, novellis puberulis ; folia longe-petiolata, 4—6 poll. longa, lanceolata v. oblongo-lanceolata, utrinque acuminata, integra, membranacea, subtus in costa nervisque puberula, discoloria ; petiolus $\frac{1}{2}$ -2 poll. longus, puberulus ; racemi terminales, puberuli, plerumque solitarii v. terni, bracteati ; bracteolæ lineares, sursum gradatim subulatæ ; flores albidus v. carneo-albidi, brevissime pedicellati ; corolla 3 lin. longa, lobis calycinis puberulis paulo longior ; stylus et filamenta glabra ; capsula 3 lin. longa, glabra.—Karen hills, Taipo-mountains, Thoungyeen. (Dr. Brandis).

BIGNONIACEÆ.

106. *Spathodea ignea*, n. sp.

Arbor mediocris, novellis sparse puberulis; folia decomposita, pinnis primariis 3—4, secundariis infinis sæpius bipinnatis, sequentibus simpliciter impari-pinnatis; foliola 3—4 poll. longa, oblique oblongo-lanceolata, obtuse acuminata, breviter petiolata, integra, tenuiter chartacea, glabra; flores speciosi, ignei, fasciculati v. breviter racemosi, in foliorum axillis v. frequentius e ramis crassioribus supra foliorum cicatricibus erumpentes; pedunculi et pedicelli puberuli; calyx spathaceus, $\frac{3}{4}$ poll. longus, puberulus, membranaceus; corolla bipollicaris, campanulato-infundibuliformis, glabra, intus versus basin ad filamentorum insertionem puberula, breviter 5-loba, lobis rotundatis obtusissimis; filamenta glabra, usque ad medium corollæ adnata, filamentum quintum abortivum, breve v. rudimentarium; antheræ faucem attingentes; folliculi immaturi, bipedales, lineares, glabri, apice truncati, valvis coriaceis tenuissime striatis; semina divaricato-bialata, biseriata.—Burma, without locality. (Hb. Dr. Brandis, No. 1357).

COMMELINACEÆ.

107. *Aneilema spectabile*, n. sp.

Planta perennis, subacaulis; radices elongato-tuberosæ, sursum attenuatæ; folia subradicalia, lato-lanceolata ad lato-linearia, basi rotundata, amplexicaulia, acuminata, 2—5 poll. longa, supra puberula, subtus glabra, caulina multo breviora, solitaria et magis puberula; panicula foliorum longitudine v. paulo longior v. brevior, racemiformis v. raro subramosa, bracteata, radicalis et scapiformis, solitaria v. raro bina, tota cum bracteis dense glanduloso-puberula; bracteæ oblongæ, acuminatæ, semipollicares, amplexicaules et subcymbiformes, florum racemulos laxos foventes; flores exsertæ, cyanescenti-albidi (in sicco cyanei), longe pedicellati; pedicelli stricti, filiformes, glandulosi, c. 2 lin. longi; sepala linearia, 2-2½ lin. longa, acutiuscula, extus glanduloso-puberula; petala sepalis breviora; stamina fertilia forte 2; ovarium 3-loculare, loculis 3-ovulatis; capsulæ maturæ sepala longitudine subæquantes, oblongæ, acutiusculæ, glabræ, 3-loculares, loculis abortu 1—2 spermis; semina parva, lato-ovata ad truncato oblonga, planiuscula, lacunoso-rugosa,

pallida.—Burma, Thoungyeen, March, 1862. (Dr. Brandis).—This species will range along with *A. ochraceum*, Dalz.

LYCOPODIACEÆ.

108. *SELAGINELLA SEMICORDATUM*, J. Scott, (in Journal of Agricult. Society of India. New Ser., vol. I, part 2, p. 261 (1860) is *S. semicordata*, Spring, Enum. *Lycopod.* No. 78 and Monogr. *Lycopod.*, II, 107 (*Lycopod.* Wall. Cat. 137).

S. implexa, J. Scott, l. c. p. 262, is identical with *S. tenera*, Spring, Enum. *Lycop.* No. 144 and Monogr. *Lycopod.*, II, 241.

S. aristatum, J. Scott, l. c. 262, founded apparently upon *Lycop. aristatum*, Roxb., in Maclell., Calcutt. Journal. Nat. Hist., IV, 473, is unknown to me, and it is impossible to compare the plant with any of Spring's diagnoses, Mr. Scott's description being insufficient in several points.

LEMNACEÆ.

109. *Lemna tenera*, n. sp.

Frondiculæ cruciatæ, lanceolatæ ad lineari-lanceolatæ, sæpius subcurvulæ, acuminatæ, basi magis minusve rotundatæ, membranaceæ, subtus (in viro) obsolete trinerves et reticulato-venosæ; radiculæ solitariae.—Frondiculæ 3—4 lin. longæ, basi lineam circiter latæ; radiculæ vix pollicares.

Pegu, in jungle-swamps of Pazwoon dOUNG valley, rare.

ARRANGEMENT FOR THE DISCHARGE OF LONG OVERLAND TELEGRAPH LINES, by LOUIS SCHWENDLER, Esq.

[Received 27th January, 1871.]

When organizing more regular and instantaneous telegraphic communication between the Presidency towns of India, and especially between Calcutta and Kurrachee, it was observed that discharges occurred sufficiently strong to affect the relay of the sending station, and giving rise to the so called "return beats." These discharges* through the relay of the sending station are

* It is well known that an overland telegraph line acts as a Leyden jar in the same manner as a submarine cable, having, however, only a much smaller capacity on account of the insulating layer (the air between the telegraph wire and surrounding conductors) being very thick. But, though the capacity

inconvenient for many reasons, the most important of which is, that they are frequently stronger than the signalling current of a far distant station, and consequently throw the relay out of its adjustment, and so make it unfit to receive a calling signal from such a station. It was, therefore, necessary to devise some simple means by which these discharge currents could be safely eliminated from the relay of the sending station,* and it was found that for terminal stations a peculiarly constructed key answered the purpose best. This key, after each signal sent, by a proper application of well tempered springs, makes a momentary contact direct with earth, by which the discharge of the line is effected before the final contact with earth through the relay is made, and such keys were supplied to the terminal stations of the Indian main lines, where they have worked well. But to eliminate the discharge currents from the relays of terminal stations is of far less importance, than to do so from the relays at translation stations; for it is clear that the discharges in translation stations may not only be inconvenient, but may momentarily interrupt the line, so that the real signal cannot pass on; and even if they do not cause interruption during the whole of a signal, they will, at all

may be small in comparison with that of any cable, it is evident that a long, well insulated overland line may shew nevertheless very decided charges and discharges. Fortunately the charges of the Indian Main lines, (so long in comparison with the direct worked lines in Europe), still occupy such a short time as not to influence in the least our maximum working speed attainable with the present signalling system (25 to 30 words a minute), *i. e.* a signal sent from Calcutta to Agra arrives there practically at the very moment it is sent. The discharges, however, affect most seriously our instruments, and it is, therefore, only this effect that is treated of in the present paper.

* The method of a station permanently cutting out its own relay while sending has never been adopted in this country, and I believe also never will be, for however perfect lines and instruments, and accomplished employés may be, or may become, it is always highly desirable that a receiving station should be able to call in the sending station at any moment during the transmission of a message.

In India we invariably use positive currents, (or copper to line), for signalling, because they reduce the leakage. By using positive currents for signalling in one direction and negative currents in the other, and having polarized receiving instruments, the effect of discharges would be of course so far eliminated that the receiving instruments would not actually be worked by them, the discharges going in the wrong direction through the polarized relays. But this is a bad plan. The continued passage of strong discharges through a polarised relay make it, on account of remanent magnetism, unsensitive, and consequently a continual and most tedious adjustment of the receiving relay would be necessitated; this again would produce great irregularity in the working of the lines.

events, produce points instead of bars at the receiving station, thereby causing considerable delay and confusion.

It is true that in principle the arrangement in use at terminal stations might also be applied at translation stations, where the armatures of the sounders, or any other receiving instruments, act as keys; but there are many mechanical difficulties in the way, especially the very small play of these armatures which would make such a method unsafe. It was, therefore, decided to use for translation stations another discharging arrangement, which I will now describe. This arrangement consists of a Siemens' polarized relay with comparatively small resistance, and of a small bobbin of wire acting as a shunt to the coils of the relay, which latter may appropriately be called the "Discharging relay." The parallel circuit of discharging relay and bobbin of wire is interposed between the line to be discharged after each signal and the sending battery.

The contact screw of the discharging relay is connected with one end of the receiving relay, while the axis of the tongue of the discharging relay is in connection with the other end of the receiving relay, *i. e.* the earth. Such an arrangement may be of course applied equally well for terminal stations in place of a discharging key, and as the telegraph circuit for two terminal stations is of a simpler nature than the translation circuit, it will be clearer to explain the action of this discharging arrangement for two terminal stations working direct with each other, as for instance, Calcutta and Agra.

The following diagram (Fig. 1) will give all the necessary connections.

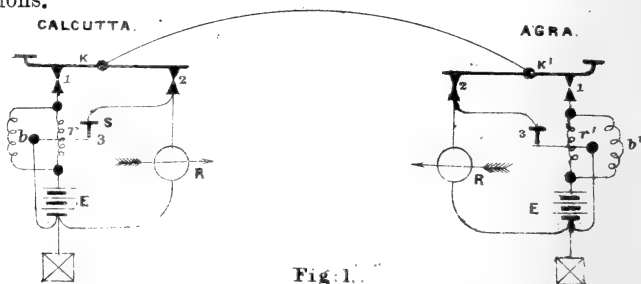


Fig. 1.

R and R' are the receiving relays, the tongues of which, when a current is sent, close the circuit of a local battery, containing the receiving instrument in the usual manner.

K and K' are two common telegraph keys, r and r' the two discharging relays, b and b' the two bobbins of wire acting as shunts to r and r' respectively.

Suppose Calcutta sends a signal to Agra by pressing the key K on its front contact 1, then a part of the Calcutta signalling current passes through r , and if strong enough, attracts the relay tongue, pressing it against the contact screw S, and as long as contact 1 lasts, contact 3 will exist. But as soon as the signal is completed, *i.e.* when the key leaves contact 1 and makes contact 2, all the discharge of the long line would pass through the receiving relay R, if contact 3 ceased just before contact 2 were re-established. This is, however, not the case, because by the application of the shunt b , in virtue of which an extra current can form itself through the coils of the discharging relay, contact 3 is sufficiently prolonged to exist for a moment simultaneously with contact 2, consequently the whole discharge, or at least the greatest part of it, has time to pass through contact 3 direct to earth, instead of going through the receiving relay R. The same process will of course repeat itself at each signal sent, and will also be the case when Agra is sending instead of Calcutta.

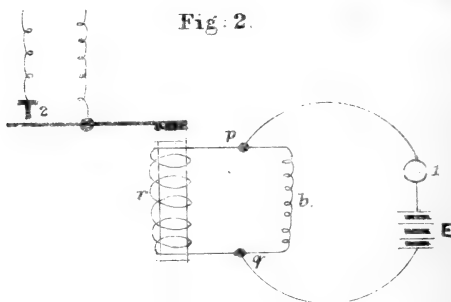
Such an arrangement answers the purpose perfectly at Agra on the great and important main line between Calcutta—Kurrachee, where it has been in use (in translation) for some time.

It may be mentioned here that it does not at all interfere with the maximum working speed, attainable with our present system of signalling, namely 25—30 words a minute.

The very great prolonging power of such a shunt not having been known at first, it was thought necessary to assist the prolonging effect by a fine spring of very small play, fixed to the tongue of the *discharging relay*. But such a spring is not wanted, and it is much better to dispense with it, because, however small the play of this contact spring may be made, it will always in some measure lessen the sensitive adjustment of the discharging relay.

As it was evident that the prolonging effect of the shunt must greatly depend upon its resistance, (supposing the resistance of the discharging relay and also all other circumstances were given), the following investigation was made in order to ascertain its amount.

Figure 2 represents the simple circuit as obtained from diagram 1.



Two bobbins of wire, r and b , are connected parallel to the two poles of a battery E , the circuit of which may be closed and opened at will by a stopper, 1. Only one of the bobbins, r for instance, contains iron, which becomes a magnet as soon as the battery circuit is closed. When the circuit is opened, the magnetism in r ceases, causing an extra current in $(r + b)$ which acts in the same direction as the original battery current, and consequently causes the loss of magnetism in r to go on much slower, than it would without such a shunt b ; and therefore, if the magnetism in r were made use of for closing a contact 2, this contact would be somewhat prolonged by such a shunt. Consequently the question to be solved is, what must be the resistance of this shunt, supposing r , and everything else were given, in order to make the remanent magnetism a maximum, *i. e.* the prolonging effect of the shunt as regards contact 2 greatest.

That for a given r a certain b does exist for which the extra current, or its equivalent the remanent magnetism, is greatest, follows simply enough. Suppose for instance the resistance of the shunt b were infinite, which is the same as having no shunt at all, then no extra current would exist, though its cause, *i. e.* the mag-

netism produced in r by closing the battery circuit, would be greatest. On the other hand, if the resistance of the shunt b were taken as infinitely small, then, (though there would be the best possible channel for an extra current), no such current could be established, because no original current would pass through r , and therefore no magnetism in r could have been developed. Knowing, therefore, that for $b = \infty$ and for $b = 0$ the extra current is $= 0$, it follows that there must be one or more values of b between these limits, for which the extra current is a maximum.

However, the function, by which this extra current, or better the remanent magnetism in r , is expressed, is of such a nature, that it has only *one* maximum, and this can easily be calculated, since all the laws determining it are perfectly known.

In diagram 2 we will designate by r the resistance of the bobbin producing the magnetism (which in the discharging arrangement represents the resistance of the coils of the discharging relay); and for brevity we may suppose that the whole resistance between the points p and q through r is used for producing magnetism.

Suppose also—

n the number of convolutions in r ;

x the resistance of the bobbin acting as a shunt to r , and extending between p and q ;

E the electromotive force producing the original current;

l the resistance between the points p and q through the battery E , including the resistance of the battery;

thus the current C which passes through r , when l is closed is—

$$C = E \frac{x}{l(r+x) + rx},$$

and consequently the magnetism m , developed in r by C is:

$$m = C n = E \frac{nx}{l(r+x) + rx},$$

and, supposing the conductivity of the wire, filling the given space of bobbin r , constant for any diameter whatever, and neglecting the thickness of the necessary insulating covering of the wire in comparison with its diameter, we may substitute for n the value $n = \text{Constant} \sqrt{r}$.

Thus we have—

$$m = E \text{ Const } \frac{x \sqrt{r}}{l(r+x) + r x}.$$

The ceasing of this magnetism, after the battery circuit has been instantaneously opened at 1, must be considered as the cause for producing an extra current in the closed circuit $(r + x)$, which extra current in its turn reproduces magnetism in the iron bar in the coil r . This whole process of course occupies time, however short it may be and goes on steadily. But it will lead apparently to the same result for our purpose, if we suppose that the cessation of the original magnetism produces instantaneously the whole extra current, and that the extra current, (or better an average value of it, since it is variable as regards time), is used for producing fresh magnetism in the iron bar of the coil r . Under these circumstances it is reasonable to take a proportional quantity of the original magnetism as the new electromotive force for producing the extra current C' in the circuit with the resistance $r + x$.

Therefore we have

$$C' = E \text{ Const } \frac{x \sqrt{r}}{\left\{ l(r+x) + r x \right\} (r+x)},$$

and this expression multiplied by the number of convolutions, n , gives us the remanent magnetism m' , or as $n = \text{Const } \sqrt{r}$,

$$m' = E \text{ Const } \frac{x r}{\left\{ l(r+x) + r x \right\} (r+x)} \dots \dots \dots \text{(I)}$$

Now it is evident that the prolonging effect, *i. e.* the time during which the bar of iron keeps perceptibly magnetized after the instantaneous opening of the battery circuit, must increase with m' , and consequently by making m' a maximum, the prolonging effect of the arrangement must also be greatest. Taking, therefore, in the above expression for m' , x only as variable, we get in the usual way

$$* x = r \sqrt{\frac{l}{l+r}} \dots \dots \dots \text{(II)}$$

corresponding to the maximum of m .

* We have—

$$\frac{dm}{dx} = \frac{l r^2 - x^2 (l+r)}{N^2},$$

In the application to a long overland line, l represents the line resistance including the resistance of the sending battery and distant receiving relay, while r is the resistance of the coils of the discharging relay.

In order to weaken as little as possible the signalling current by the introduction of such a discharging relay, we take naturally r , its resistance, only so great, that a given electromotive force, (as is generally used for signalling through the line), will work it with safety through the given line resistance, and if the discharging relay is of a good construction, this r can always be neglected in comparison with l .

Therefore we have from formula (II)

$$x = r.$$

Or to make the prolonging effect of the shunt a maximum, its resistance must be equal to the resistance of the coils of the discharging relay. This law will hold good for any long overland Telegraph line,

$$\text{where } N = \{ l(r + x) + r x \} \{ r + x \}$$

$$\therefore \frac{d^2 m}{dx^2} = - \frac{2x(l+r)}{N^2} - \frac{2}{N} \cdot \frac{dm}{dx} \cdot \frac{dN}{dx}$$

$$\therefore \text{when } \frac{dm}{dx} = 0$$

$$x = r \sqrt{\frac{l}{l+r}}$$

$$\text{and } \frac{d^2 m}{dx^2} = - \frac{2x(l+r)}{N^2}$$

which is always negative for a positive value of x .

The function m' (formula I) is to be considered as representing the remanent magnetism in the closed circuit ($r + x$), no matter by which of the two coils the magnetism is produced; thus m' must necessarily be symmetrical as regards r and x . But having selected one of the two coils by which m' , the remanent magnetism, is to be produced, it is at once fixed which of the two coils must be taken as variable in order to find the maximum of m' . If, for instance, r is taken as the coil developing m' , while x acts as shunt only, neither producing extra current nor magnetism, then the shunt x must be taken as variable

$$\text{and not } r, \text{ since otherwise factor } \frac{r}{\{ l(r+x) + r x \} \{ r + x \}}$$

would have to be differentiated, giving that value of r which represents a maximum of m' , developed by x ; just the case to be avoided as much as possible.

and it is only for a long line that such a discharging arrangement is required.

As regards the absolute value of r , it was found that 200 S. U., using a Siemens' polarized relay, were quite large enough. Such a relay works safely with 30 Minotti's cells through 10,000 S. U.

The shunt itself, even without having iron in it, produces an extra current which is in the same direction in the shunt, as the primary current, and consequently opposes the extra current produced by the coil r in the closed circuit ($r + x$).

In order to have, therefore, the action of the coil r not too much lessened by the extra current, produced by the shunt, it is necessary to make the latter of the thinnest possible German silver wire, and wind it on a large bobbin with the convolutions as far distant from one another as possible. Another method would be to wind the bobbin bifilarly.

In conclusion I may mention that the longest main line in India is the one between Calcutta and Kurrachee 1,700 miles in length which has been worked direct now for more than two years,—Agra (which is about at the middle) only in translation. During the dry season, when the lines up-country often have an insulation of more than 200 millions S. U. per mile, it is possible to work this enormous distance altogether direct without Agra in translation; but practically nothing would be gained by this, since then on account of the great length the charge becomes so large as to reduce the speed to less than 15 words a minute, while by having Agra in translation the speed, if only the signalling system would allow of it, would reach to upwards of 60 words a minute.

(Note,) Mr. A Cappel, in his report on the Central London Office of the Electric and International Telegraph Company, states that a shunt in connection with an electro-magnet for discharging one of the cables was made use of as early as 1867, and was pronounced to him by Mr. Culley as an invention of one of the Telegraph clerks. This appears to be the first application of the extra current for this purpose, but I am not aware whether this simple principle has since been used for overland telegraph lines.

Mr. Cappel says—

“The duration of the zinc current, (necessary to neutralize, after each signal sent, the positive discharge of the cable), can be regulated by varying the resistance of the shunt, but no definite law or conclusion has yet been arrived at on the subject.”



0.12
0.10

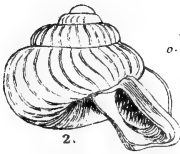
1.



1. a.

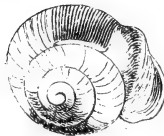


1. b.



0.145
0.10

2.



2. a.



2. b.



0.055
0.09

3.



3. a.



3. b.



0.13
0.09

4.



4. a.



4. b.



0.12
0.18

5.

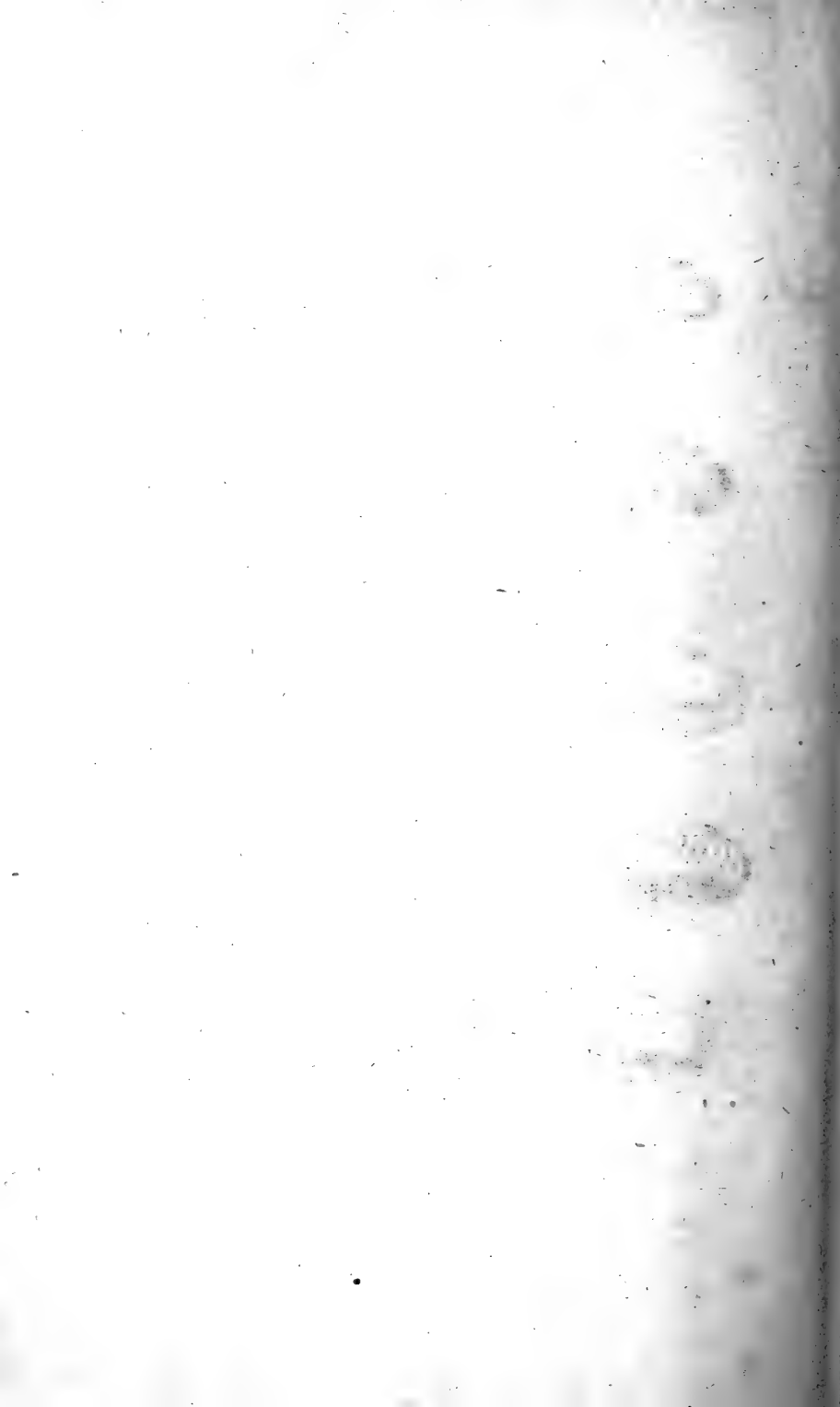


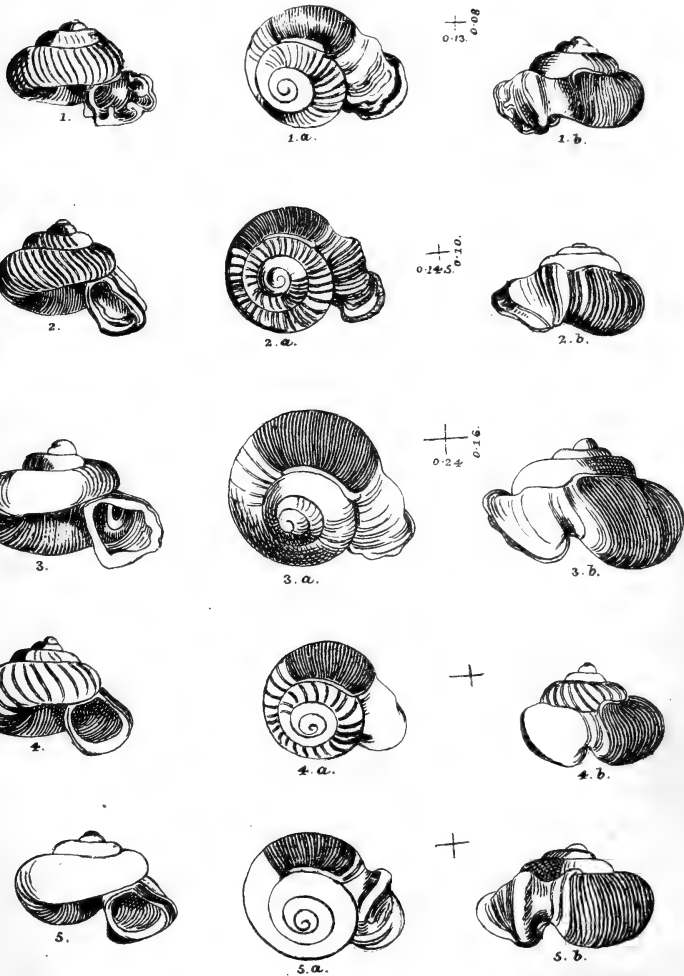
5. a.



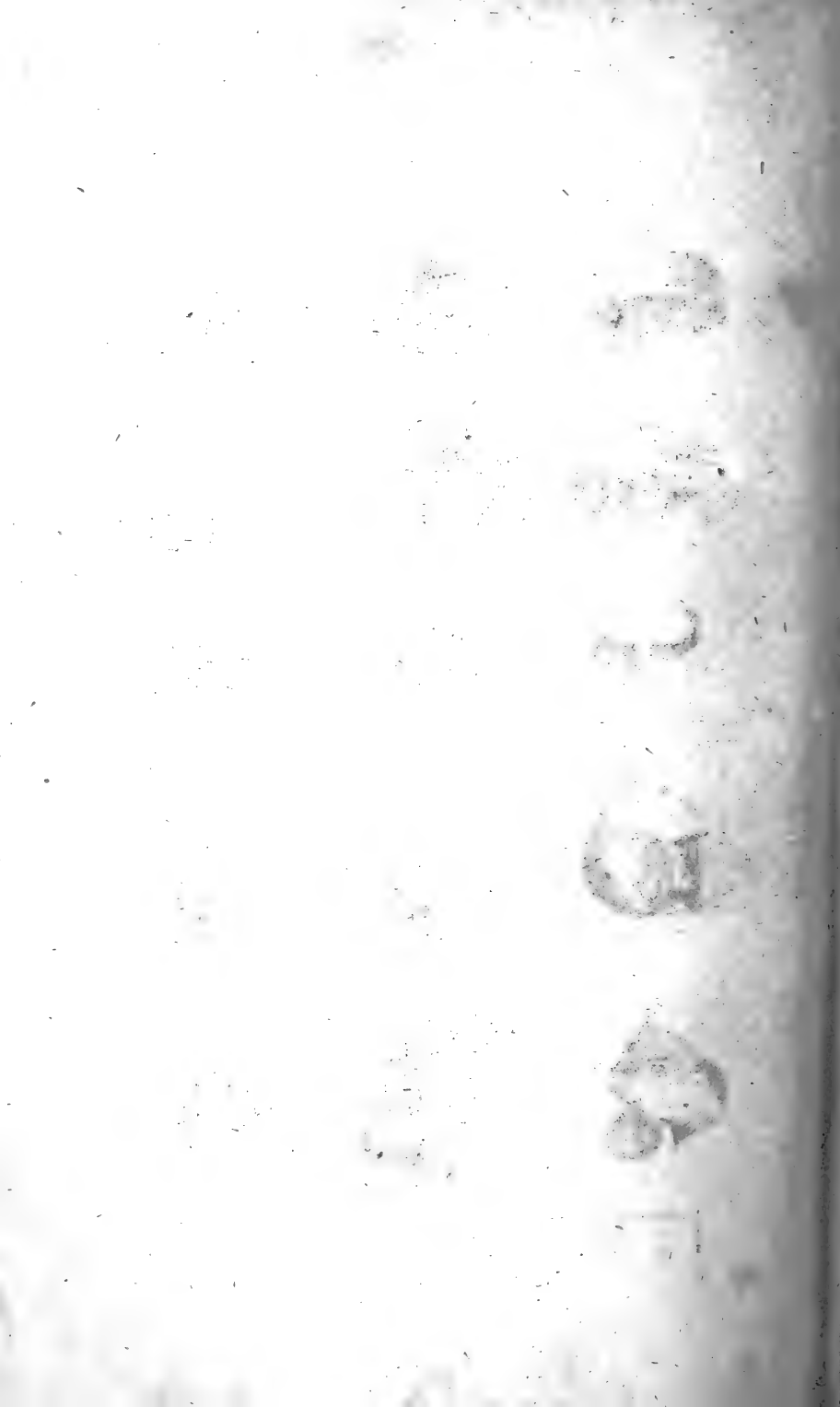
5. b.

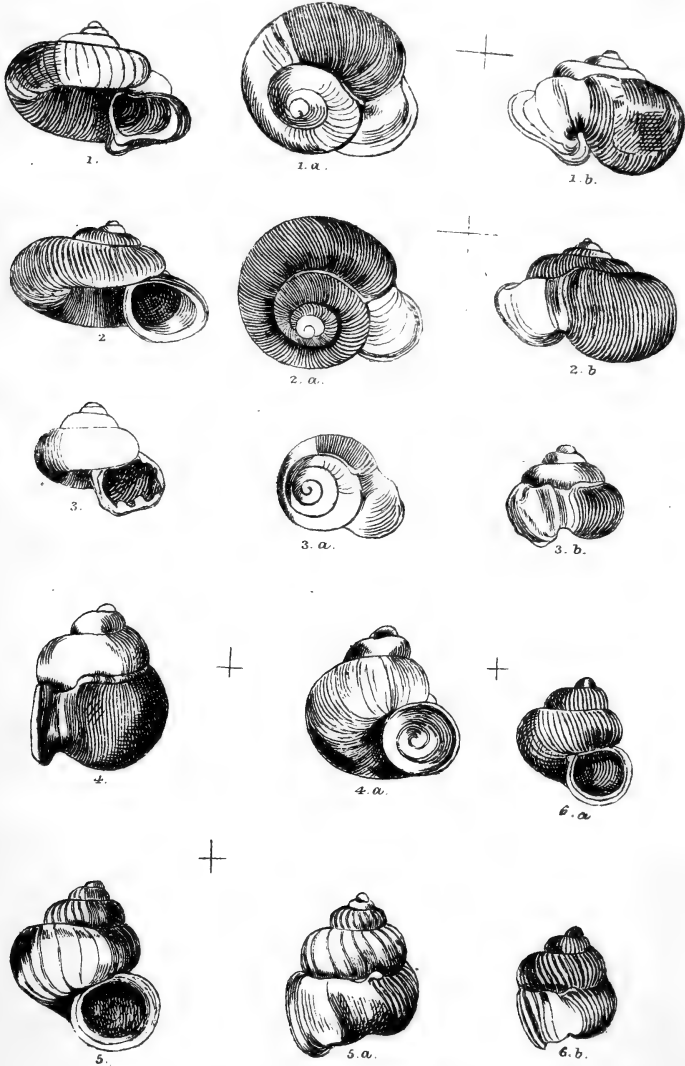
1. *Alycaeus conicus*, n. sp. 3. *Alycaeus pusillus*, n. sp.
2 " *diagonius*, n. sp. 4. " *Khasiacus*, n. sp.
5. *Alycaeus crenatus*, n. sp.





1. *Alycæus crispatus*, n. sp. 3. *Alycæus Ingrami*, W. Blf. var.
 2. *A. crispatus*, var. 4. *A. Theobaldi*, W. Blanf.
 5. *Alycæus hebes*, Benson.





1. *Alycaeus prosectus*, Bens.

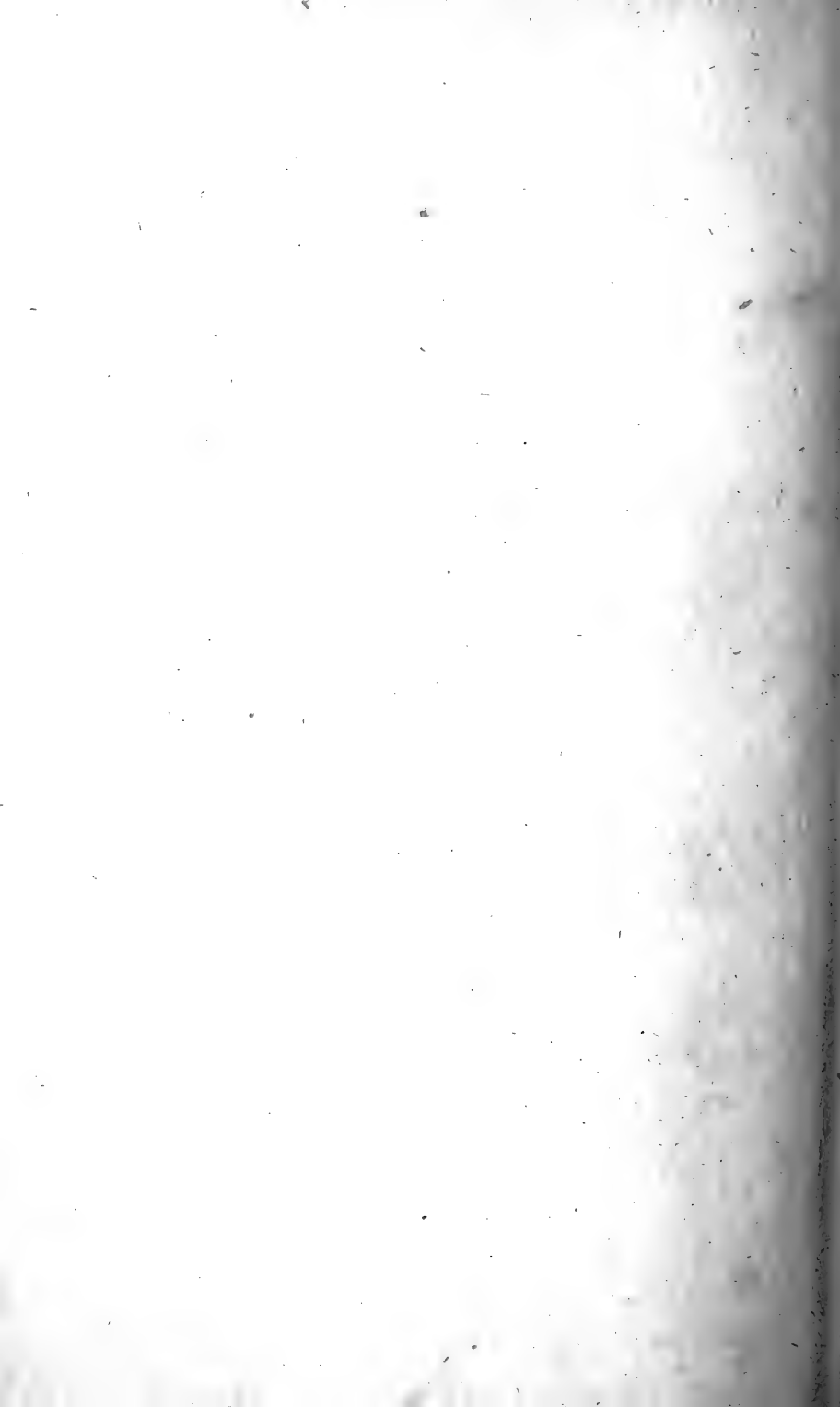
2. *A. Ingrami*, W. Blf. var. *Nagaensis*.

3. *A. Jaantiacus*, n. sp.

4. *Alycaeus (Dioryx) urnula*, Bens. var.

5. *A. (D.) graphicus*, W. Blf.

6. *A. (D.) otiphorus*, Bens. var.



DESCRIPTIONS OF THE SPECIES OF *ALYCÆINÆ* KNOWN TO INHABIT THE
KHASI HILL RANGES,— by MAJOR H. H. GODWIN-AUSTEN, F. R.
G. S., *Dy. Supt. Topogr. Survey of India.*

[With plates III-V.]

[Received 2nd Dec., read 7th December, 1870.]

The new species now described were all obtained by myself in the various portions of the hills south of the Assam valley, including the Garo, Khasi, Jaintia and N. Cachar Districts, as far east as the Burreil range on the borders of the Naga Hills. They will leave perhaps but few undiscovered forms of *Alycæi* from that part of the country.—I have figured all the species, including those described by Messrs. Benson and W. T. Blanford, save one or two, and added a list which brings the number of species up to 17.

In presenting this paper I must acknowledge to very great assistance I have at all times received from the Messrs. H. F. and W. T. Blanford, and recall the pleasure of those mornings when together with the latter my collection of *Alycæi* was compared with his fine set, and all doubts regarding their identification set at rest.

This very distinct group of the *Cyclophoridæ* cannot I think be divided in the way proposed by Benson. The only distinct sub-genus that will stand would appear to be *Dioryx*; all other distinguishing points whether of form, sculpture, constriction, umbilicus, crenulation of the peristome, vary so much in the different species that we find no correlation constant. The simple smooth form of the whorl between the peristome and sutural tube and that crossed by a distinct ridge would seem to be the only well marked distinctions we can seize on, and even here we have a passage as shewn in some specimens of *A. sculptilis* and *A. crispatus*.

***Alycæus conicus*, n. sp.** Plate III, fig. 1.

Shell narrowly umbilicated, turbinate, thick, translucent, pale corneous, pink or white, quite smooth, with shiny lustre in fresh shells, with very strong regular filiform costulation on the tumid

portion of the last whorl, the sculpture terminating abruptly both in front and behind with the exception of some raised striæ close behind the termination of the sutural tube; indistinct ribbing near the umbilicus. Spire conoid, apex obtuse; suture impressed; whorls 4-4½, rounded, last very slightly swollen, constricted and enlarging slightly again near the aperture. Constriction smooth, rather short; sutural tube moderate commencing at .045 inch distance from the mouth. Aperture slightly oblique, a perfect circle; peristome double, thick, inner continuous, projecting, slightly expanded, the outer retroflect. Operculum horny, multispiral, concave in front; smooth behind, no central boss.

Ordinary size.—Major diam. 0.12" to 0.13".—Minor diam. 0.11".—Alt. 0.10" to 0.11". Diam. of aperture 0.06".—Sutural tube, 0.045".

Habitat. Was abundant on the Limestone Hill east of Kopili river, North Cachar District, and was occasionally also found in other places, but rare.

This shell is very close to *Alycæus vestitus*, W. Blanford, but differs in its smaller size, the upper whorls being quite smooth, and in the ribbing near the sutural tube being more strongly and coarsely marked and in ending abruptly with it.

***Alycæus diagonius*, n. sp. Pl. III, fig. 2.**

Shell closely umbilicated, turbate, thin, translucent, pale amber or pinkish colour, finely but distantly costulated on the two last whorls, closely so on the inflated portion of the last. Spire conoid, apex blunt, suture well impressed, whorls 4, rounded, constricted closely near base of the sutural tube, then swelling largely towards the mouth, the commencement of the swell forming a diagonal or recurved ridge above. Constriction smooth, sutural tube 0.053 inch; aperture diagonal, circular, peristome sinuate, double, inner lip continuous, outer expanded, slightly reflected at umbilicus and partially concealing it.

Operculum concave in front, convex behind with a small central boss or nucleus.

Major diam. 0.145".—Minor diam. 0.120".—Alt. 0.10".—Diam. of aperture, 0.075".

Habitat. The Diyung valley, north of Asálú, in N. Cachar District.

This shell is at first sight, very like *A. hebes*, Bs., but can easily be distinguished by its much narrower umbilicus, its more polished surface and less expanded mouth.

A small variety of this shell was obtained and deserves special notice. The striation is wanting throughout, and the costulation on the swollen portion of the last whorl is somewhat shorter; in these characters it approaches very near to *A. nitidus*, W. Blanford, from Arakan, but the recurved rib is in this last species much less developed.

***Alycæus pusillus*, n. sp. Pl. III, fig. 3.**

Shell depressly turbinate, moderately umbilicated, thin, translucent, vitreous, pale horny, smooth, rarely shewing any signs of costulation, the sculpture when present is very fine and distant; closely and regularly ribbed on the expansion of the last whorl, also within the umbilicus. Spire depressly conoid, apex blunt, suture moderately impressed, whorls $3\frac{1}{4}$, the last scarcely swollen. Constriction very slight, smooth, sutural tube very short and thick; aperture oblique, round, peristome double, inner continuous, both lips expanded. Operculum thin, horny, transparent, multispiral, slightly concave and without central boss at back.

Major diam. 0.09".—Minor diam. 0.075".—Alt. 0.055".—Diam. of aperture, 0.035".—Sutural tube, 0.012".

Habitat. This shell was first found by me near Jawai, it is an abundant form in some localities, especially on the banks of the Kopili river on the road from Jawai to Asálú, viâ Súfai.

The species is very similar to *A. humilis* described by Mr. W. T. Blanford, from Akouktoung, Burma, but this last is a larger, thicker shell, and the outer lip is reflected near the umbilicus which is not so open, as in the new shell above described. On a comparison of the *Alycæi* in Mr. W. T. Blanford's collection and those obtained by me, *A. humilis* also turned up; I had previously noted the shell as differing from *H. pusillus*.

A. humilis is common at Nongtúng in the Jaintia hills; it has also been found in the W. Khasi Hills, and as far east as the Jhiri

river on the border of Manipúr; in this last locality the form is again slightly different with a shorter constriction, and approaches *A. conicus*, n. sp.

***Alycæus Khasiacus*, n. sp. Pl. III, fig. 4.**

Shell sub-turbinately depressed, openly umbilicated, translucent, varying, much in colour from horny amber to pink and dark red browns, a shining surface, very finely striated under lens, very minute ribbing on the swell of the last whorl; in some specimens, a faint costulation is seen. Spire depressedly conoid, apex very blunt, often darker coloured than rest of the shell. Suture impressed, whorls 4, well rounded, last moderately swollen, sharply constricted and again enlarging into two vertical ridges, that nearest the mouth being the least developed, and only extending across the upper portion of the whorl, being cut off by the peristome. Constriction smooth, sutural tube very short and thick at the base. Aperture oblique, round, slightly angulate above. Peristome more or less distinctly double, inner continuous, outer slightly expanded. Operculum multispiral, very concave in front, convex behind, no boss.

Major diameter, 0.15".—Minor diam. 0.13".—Alt. 0.09".—Diam. of aperture 0.07".—Sutural tube, 0.025".

Habitat. On the highest parts of the Khasi and Jaintia Hills, abundant.

The very short tube and very fine ribbing on the last whorl, and the plain surface of the rest of the shell, combine to make this a very distinct and well marked species of the genus *Alycæus*.

A variety has the aperture less circular, with a distinct notch below, in every other respect it is identical, but a little smaller. All found in Shillong hill station were of this last type.

***Alycæus crenatus*, no. sp. Plate III, fig. 5.**

Shell moderately umbilicated, depressedly turbinate, rather thin translucent, pale horny or white, epidermis of former colour, peeling off in old shells, with very fine indistinct costulation throughout, fine close ribbing on the swell of the last whorl. Spire depressly conoid, apex very blunt, suture well impressed. Whorls 4, round-

ed, the last moderately swollen, constricted close to base of sutural tube, with a marked subvertical ridge just behind the mouth. Constriction smooth, sutural tube long, rather thick,—aperture oblique; peristome round, deeply waved on the upper and outer but not on the columellar margin, outer lip small, slightly expanded. Operculum multispiral, concave in front, with a small projecting boss at the back.

Animal pale coloured, tentacles dark brown.

Major diam. 0·18".—Minor diam. 0·16".—Alt. 0·11".—Diam. of aperture 0·08".—Sutural tube, 0·75".

Habitat. On Burrail Range, N. Cachar, at about 5000 feet.

Near *A. plectocheilus*, but much larger, the ridge more distant from the peristome and the latter more expanded. In some specimens, the edges of the outer whorls in the operculum are much raised and bent inwards as in *Cyathopoma*.

***Alycæus crispatus*, no. sp. Pl. IV, fig. 1.**

Shell moderately umbilicated, turbinate, rather thin, pale horny with fine sub-distant plicate costulation on the upper part of the whorls near the suture, smoother below, finely and closely ribbed on the swollen portion of the last whorl. Spire conoidal, apex rather acute, suture well impressed. Whorls 4, rounded, the last moderately swollen at the side, next constricted and smooth for a short distance, then traversed by a slightly recurved ridge, more developed in some specimens than in others, with a nearly smooth interval behind the mouth, but gradually becoming impressed with longitudinal undulations near the peristome. Sutural tube moderate. Aperture diagonal, waved on the outer and upper margins. Peristome thickened, irregularly double, expanding with 4 or 5 deep undulations on the right side, extending from the point of junction with the last whorl to the base of the aperture; the inner salient angles strongly projecting in aged specimens. Operculum multispiral, thickened, convex behind, very concave in front.

Habitat. Khasia, Jaintia and N. Cachar Hills, abundant.

This form is a close ally of *Alycæus sculptilis*, Bs. A variety was obtained in the eastern side of the Hill ranges near Asálú &c., and

figured in Pl. iv, fig. 2; it differs from Benson's Burmese species in having a well marked ridge on the constriction and an expanded peristome to which there is no tendency in *A. sculptilis*, Bs.

ALYCÆUS INGRAMI, W. Blf., var. Plate IV, fig. 3.

Differs from the described form from Arakan, in the mouth being larger, and there is a tendency to undulation on the outer margin of the peristome, generally 2 notches are present.

Major diameter, 0.24".—Minor diam. 0.24".—Alt. 0.16".—Diam. of aperture 0.11".—Sutural tube, 0.09".

Habitat. Neighbourhood of Asálú, N. Cachar Hills.

This shell assimilates in some respects *A. prosectus*, Bs.

ALYCÆUS INGRAMI, var. **Nagaensis**, Plate V, fig. 2.

Shell depressedly globose, openly umbilicated, thick, slightly translucent white, generally covered with a thin muddy coating, finely and sharply costulated throughout. Spire depressly conoid, apex blunt, suture impressed, whorls 4, rounded, the last much swollen, constriction close to the base of sutural tube, slightly swelling again towards the mouth, quite smooth, sutural tube very long and thin. Aperture oblique, circular, peristome double, both lips close and slightly expanded. Operculum black, smooth and concave in front, convex at back, with a central boss.

Major diam. 0.20".—Minor diam. 0.32".—Alt. 0.29".—Diam. of aperture 0.15".—Sutural tube, 0.15".

Habitat. Neighbourhood of Asálú, rather local in its distribution, but then abundant.

Its well costulated surface distinguishes it from the preceding variety of *A. Ingrami*.

Alycæus Jaintiacus, no. sp. Pl. V, fig. 3.

Shell sub-obtusely perforated, turbinate, pale amber or white, smooth, finely ribbed on the swollen portion of the last whorl, with sign of sub-distant ribbing behind the termination of the sutural tube. Spire conoid, apex blunt, suture impressed. Whorls 4, rounded, last very slightly swollen, then moderately constricted, swelling again in a low ridge, somewhat recurved. Constriction smooth; sutural tube, rather short, fine, aperture sub-vertical,

round. Peristome deeply waved within; salient angles between the undulations nodose, inner lip continuous, outer reflected considerably near the umbilicus.

Major diam. 0·13".—Minor diam. 0·11".—Alt. 0·10".—Diam. of aperture 0·07".

Habitat. Obtained in Nongjinghi Hill, Jaintia; by no means abundant.

ALYCÆUS OTIPHORUS, Bs. var. Pl. V, fig. 6.

This is a closely allied shell to Benson's type, differing, however, in its smaller size, stronger sculpture and in having very fine lines of sculpture on the constriction, close behind the peristome.

Major diam. 0·13".—Minor diam. 0·10".—Alt. 0·14".—Diam. of aperture with the peristome, 0·06".

Habitat. Wooded slopes of the Maugut river and Marangksi Peak, Jaintia Hills, rather a rare shell. The same variety of *Alycæus otiphorus* was also obtained in N. Burmah by Dr. Anderson, when proceeding with the mission to Yunnan.

ALYCÆUS SCULPTILIS, Bs.

This species was found at Mao Kasa, differing in no respect from Burmese specimens of that shell.

List of known *Alycæi* from Khasi Hill ranges.

<i>A. otiphorus</i> , Bens. var.	Pl. V, fig. 6.
<i>A. graphicus</i> , W. Blf.	Pl. V, fig. 5.
<i>A. crenatus</i> , no. sp.	Pl. III, fig. 5.
<i>A. Jaintiacus</i> , no. sp.	Pl. V, fig. 3.
<i>A. crispatus</i> , n. sp., var.	Pl. IV, fig. 2.
<i>A. crispatus</i> , no. sp. (typical)	Pl. IV, fig. 1.
<i>A. Ingrami</i> , W. Blf., var.	Pl. IV, fig. 3.
<i>A. Ingrami</i> , W. Blf., var. <i>Nagaensis</i> ,	Pl. V, fig. 2.
<i>A. prosectus</i> , Bens.	Pl. V, fig. 1.
<i>A. pusillus</i> , no. sp.	Pl. III, fig. 3.
<i>A. conicus</i> , no. sp.	Pl. III, fig. 1.
<i>A. Theobaldi</i> , W. Blf.	Pl. IV, fig. 4.
<i>A. hebes</i> , Benson,	Pl. IV, fig. 5.
<i>A. diagonalis</i> , no. sp.	Pl. III, fig. 2.
<i>A. Khasiacus</i> , no. sp.	Pl. III, fig. 4.
<i>A. (Dioryx) urnula</i> , Benson,	Pl. V, fig. 4.
<i>A. sculptilis</i> , Bs.	
<i>A. humilis</i> , W. Blf.	



JOURNAL

OF THE

ASIATIC SOCIETY.

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The following papers are transcripts from those notes which, however, still contain many a gap that will have to be filled in, whilst several of the enumerated species, when rediscovered, will also have to be redescribed. Still it appears desirable to publish them in this incomplete form, in the hope that additional information may be obtained from others who are interested in the enquiry, so as to render it possible at some future date to complete an illustrated Manual of the fishes of India. The reason why the *Carp*s have been chosen as the first family is merely, because they are the most important in an economic point of view; and the CYPRI-
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JOURNAL
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ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. II.—1871.

MONOGRAPH OF INDIAN CYPRINIDÆ, (*Part I.*)—
by SURGEON FRANCIS DAY.

[With Plate IX.]

[Received and read 4th January, 1871.]

Whilst employed investigating the present state of the fresh-water fisheries of India, one of the first subjects which engaged my attention, was the completion, as far as practicable, of detailed descriptions of the fishes inhabiting those localities, appending their native names whenever procurable.

The following papers are transcripts from those notes which, however, still contain many a gap that will have to be filled in, whilst several of the enumerated species, when rediscovered, will also have to be redescribed. Still it appears desirable to publish them in this incomplete form, in the hope that additional information may be obtained from others who are interested in the enquiry, so as to render it possible at some future date to complete an illustrated Manual of the fishes of India. The reason why the *Carp*s have been chosen as the first family is merely, because they are the most important in an economic point of view; and the CYPRININÆ for the same cause are placed before the HOMALOPTERINÆ and COBITIDINÆ.

At the present time the Fish-fauna of large portions of India is almost unknown; this is more especially evident in the Bombay Presidency, where only Colonel Sykes has written on the fresh-water fishes, and his published notes embrace less than fifty species from the Deccan, twenty of which are very insufficiently described. The ichthyology of most of the Hill-ranges remains still to be discovered, whilst specimens for the local Museums from every locality are greatly needed.

The literature of the *Carps* of India is extremely scanty, being as follows: Russell, in 1803, in his "Fishes of Vizagapatam" only records three, all of which probably belong to a single species. Hamilton Buchanan in 1822, in the "Fishes of the Ganges" records ninety-five carps, but amongst them are several varieties. McClelland in 1839, in the "Transactions of the Asiatic Society of Bengal" published a Memoir on the "INDIAN CYPRINIDÆ," recording one hundred and thirty-two species, many of which are considered in these pages as synonyms. Colonel Sykes in 1831, wrote his "Fishes of the Dukhun" published in 1841, in the "Transactions of the Zoological Society of London;" in it he records twenty-seven carps, the majority of which are insufficiently described. Valenciennes in 1834, in Belanger's "Voyage aux Indes Orientales" describes a few carps. Cuvier and Valenciennes in 1842-1844, in their "Histoire naturelle des poissons" give many Indian CYPRINIDÆ, but species sometimes occur more than once, and occasionally in different genera.

Dr. Jerdon, in 1849, in the "Madras Journal of Lit. and Science" wrote two papers on the "Fresh-water Fishes of Southern India" describing sixty-two species of carps, personally collected, ten of which apparently were previously unknown. Dr. Bleeker in 1853, published in Batavia, "Nalezingen op de ichthologische fauna van Bengalen en Hindostan." Mr. Blyth in 1858 and 1860, communicated a few papers on fish, including carps, collected in Bengal, Burma, and Ceylon, in the "Proceedings of the Asiatic Society of Bengal."

Irrespective of the "Fishes of Malabar," 1865, I have between 1865 and 1871, recorded observations on Indian carps in the "Proceedings of the Zoological Society of London." The last and

most elaborate work on this subject is contained in the "Fishes of the British Museum" by Dr. Günther, who in 1868, in the seventh volume, gives about 202 Indian Cyprinoid fishes. Besides the foregoing, the works of Linnaeus and Bloch, as well as more casual authors contain remarks on some of the Indian carps, and these will be referred to under the head of the respective species.

My collections of *carps* have been personally made in the following localities: Calicut, also Vithri in the Wynaad, as well as Cochin and the neighbouring districts in Malabar; the Neilgherries and the rivers around their bases; the Kistna at Kurnool; the Cauvery and Coleroon for some miles above and below Trichinopoly, and likewise along the coast route between Tanjore and Combaconum up to Madras; from Musulipatam through the Kistna and Godavery districts to Coconada; from Gopaulpore through Berhampore, Ganjam, Cuttack and Orissa to Calcutta; from Rangoon through the Bassein district, and along the Irrawaddi to Mandalay; up the Pegu river through the Sittoung district to Moulmein, Tavoy and Mergui.

I have also received collections, containing carps, made by H. E. Thomas, Esq., Madras Civil Service, from South Canara; Mr. Assistant Apothecary Everard, from Trichoor in the Cochin district; the Rev. H. Baker, from the Cottyam Hills in Travancore; Mr. Vernéde, from the slopes of the Neilgherries; J. Burnett, Esq., from the Wynaad; Mr. Apothecary Huffton from Arcot; Dr. Nash from Mercara; Colonel Puckle from Mysore; Dr. Shortt, Wallajabad and Mysore; by Mr. Davies, from the Hill ranges above Akyab, through Colonel Stevenson; by Major Sladen at Mandalay; and likewise some species from Tibet and Darjeeling collected by Dr. Stoliczka.

As regards Museums, I have received every facility from Dr. J. Anderson in making a thorough examination of the specimens in the Indian Museum at Calcutta. At Madras, I was unable to obtain leave from the Curator to inspect the fishes in that Institution, neither had an appeal to the local Government a more fortunate result. Returning to Europe for a short period on sick leave, Dr. Günther, F. R. S., at once accorded me leave to examine the magnificent collection of fishes in the British Museum.

Having completed my descriptions, the next question for consideration was the most appropriate mode of arrangement, and though I have not separated, as families, the CYPRININÆ from the COBITIDINÆ, and these again from the HOMALOPTERINÆ, much less distinctive characters, than existing between these divisions, appear to have lately found favour for this purpose in ichthyology. The species with an air-bladder free in the abdominal cavity, those with one partially or entirely enclosed in bone, and lastly those destitute of this organ, are in the present communication merely classed respectively in three sub-families of the CYPRINIDÆ.

Commencing with the sub-family CYPRININÆ, as existing in Asia, considerable difficulty arises in selecting from amongst the various groups into which it has been divided. Too much space, however, would be occupied were I to enter upon a minute investigation of the systems of others, and the reasons why I have found myself unable to adopt them.

In forming *groups*, one of the first characters may be found by observing whether the scaled edge or margin of the abdomen is rounded or cutting, for in the majority of the Indian CYPRININÆ the abdominal edge is rounded or smooth, even when somewhat compressed, whilst in a few genera the abdominal edge posterior to the ventral fin is compressed, cutting, and may be even serrated, as in the CLUPEIDÆ; this trenchant edge in some is continued from in front of the ventral fin to the thorax.

Irrespective of the above, there are many other characters which might be employed for forming sub-groups and genera. In some, however, which might at first appear suitable for such purposes, one fails to attach that significance to their existence when large numbers of species come under review, showing the existence of connecting links. Some of these characters may be external, others are internal.

The mouth is variously formed; it may be transverse and inferior, with or without a sucker, the latter being present either on the lower lip only or existing on both; or it may be narrow, of medium size; or wide: anterior, and either antero-lateral or oblique. The lower jaw again may be prominent, sharp or rounded, shorter than the upper, or sometimes having a knob at the symphysis; a

moveable articulation may exist there, or there may be lateral prominences on the mandibles.

The lips may be exceedingly, moderately, or but slightly developed, sometimes absent from one of the jaws, closely investing both, or reflected from off one, or either. There may be an uninterrupted labial fold across the mandible, or portions of the lip may be much developed, fringed, or crenulated. Occasionally, in some genera, a horny covering to one or both lips is invariably or generally present.

The existence, number or absence of barbels has been thought by some authors to be a reason for constituting genera, but such is not generally held to be valid. These appendages in some genera,—more especially when the fish are not kept in a state of domestication, or confinement, but left in their natural situations,—appear to be pretty constant, and though not in themselves cause enough for defining a genus are frequently sufficiently well marked for the purpose of forming sub-genera, good examples of which may be seen in the genus *Barbus*, or *Barilius*. On the other hand in some species, these appendages may be abnormally absent as in the *Danio*, consequently sub-divisions of the genus founded solely on this character would lead to erroneous results.

The position of the fins indicates sub-divisions which might be used in the primary groups, and have for convenience sake been adopted as follows :—

a. Dorsal fin commencing nearly opposite the ventrals, the anal being short.

b. Dorsal fin commencing very distinctly posterior to the ventrals, but not extending to above the anal, which last is short, or of moderate length.

c. Dorsal fin commencing in the interspace between the ventral and anal, or over the latter, and generally extending to above it, whilst the anal is of moderate length or elongated.

The shape of the dorsal fin is likewise important, but its length alone, or rather number of its rays, appears insufficient for the purpose of defining a genus, much less a sub-division of a group. When an uninterrupted series extends from a few rays to a large number, and no other sufficient difference exists, such divi-

sions could not be considered natural ones, whilst, if artificial, they can never permanently stand.

The last undivided dorsal ray is variously formed, from being articulated to an osseous one which latter may be smooth or denticulated, but all these forms are sometimes found in a single genus, as *Barbus*. The anal fin sometimes shows peculiarities as in the *Barbus apogon*, C. and V., where the undivided rays are spinate.

Scales, simply as regards their size, unless conjoined to other characteristics, cannot by themselves be taken as a reason for making genera, because large, moderate, and small-sized scales are all occasionally found represented in a single genus. But certain modifications may exist, as in the mountain barbels, *Oreinus* and *Schizothorax*, where a row of tiled scales enclose the vent and base of the anal fin; or portions of the body may be naturally left scaleless.

The lateral line has been employed as one of the signs for the formation of groups, according to its position, as along the middle of the side, or near the abdominal edge; it is not here employed for such a purpose, because its complete existence in some species seems of but little importance: thus in the genera *Barbus*, or *Bariilus*, it may be present, or partially absent, sometimes ceasing after proceeding along but very few rows of scales.

As to the internal characters, the skeleton forms one of the most important features, respecting which much still remains to be investigated in the Indian carps, and the same remarks apply to the internal organs.

The pharyngeal teeth are in from one to three series, but these numbers alone do not always suffice for the definition of even genera: thus in the *Chela's* some have them in two and others in three rows. Even the form of those teeth is not invariably similar in all the species of the same genus: thus in the *Rohtee microlepis*, Blyth, these teeth have serrations on their edges and the two largest of the anterior row are molarform, whereas crooked and pointed ones are the rule in the genus. Likewise as the teeth are deciduous, being constantly shed and replaced, they may become blunted with age, although they had at first been sharp and pointed.

Lastly unrecognised species which have been collected into one genus termed *Gymnostomus** appear to consist of specimens of *Labeo*, *Cirrhhina* and *Rasbora*; the genus is consequently suppressed.

Family, CYPRINIDÆ.

Branchiostegals three: pseudo-branchiæ generally present. Body oblong or elongated: abdomen usually rounded, but, if compressed and cutting, destitute of ossicles. Margin of the upper jaw formed by the intermaxillaries. Opercles in four pieces. Mouth toothless, but from one to three rows of teeth in the inferior pharyngeal bones, which latter are strong, free, and parallel to the branchial arches. A single rayed dorsal fin. Head scaleless, body scaled or scaleless, never covered by osseous plates. No "cul de sac" to the stomach, no pyloric appendages. Air bladder if present large; it may be divided by a constriction into an anterior and posterior portion, neither of which are enclosed by bone (CYPRININÆ): or into two lateral portions, partially or entirely enclosed in a bony capsule, (COBITIDINÆ): or absent (HOMALOPTERINÆ).

Geographical distribution.—Carps are found in the fresh-waters of the Old World and North America. In India and Burma they are exceedingly numerous and of very diversified forms. During the hot months a few of the species appear to æstivate, remaining in the mud of ponds and perhaps of rivers, until the return of the monsoon or rainy season. Some of the COBITIDINÆ seem to possess aerial respiration.

* *Leuciscus rubripes*, Jerdon, M. J. L. and Sc., 1849, p. 323, from the Bowany river, requires rediscovering and redescribing, the description and original figure would make it as follows:—

D $\frac{1}{2}$, A $\frac{1}{2}$, L. l. 45, L. tr. 12.

Length of head $\frac{1}{3}$; of caudal $\frac{1}{3}$; height of body $\frac{1}{3}$ of the total length.

Eyes:—Diameter $\frac{2}{3}$ of length of head.

Profile of back slightly arched. Two barbels. Mouth very slightly oblique.

Fins.—Dorsal arises above the interspace between the ventral and anal fins.

Caudal lunate.

Lateral line.—descending at first, then nearly parallel to the abdomen, which is nearly straight.

Colours.—Green above, golden on the sides, silvery beneath; dorsal fin yellow, edged with black: pectorals yellow; ventral and anal white, tipped with vermilion; caudal pink in the centre, yellow externally.

A single specimen procured, 6 inches long.

SYNOPSIS OF GENERA.

A. Abdomen rounded, not trenchant.

a. Dorsal fin commencing nearly opposite the ventral. Anal short (5 to 7 branched rays).

1. *Psilorhynchus*, 0 barbels. Mouth inferior, transverse. Lips thick, entire, reflected from off both jaws, leaving them exposed as sharp transverse ridges, but without any horny covering. Dorsal fin short (7 branched rays), without osseous ray. Anal short, outer pectoral rays unbranched. Scales of moderate size, none on the chest. Lateral line complete. *Bengal.*

2. *Mayoa*, 4 barbels. Mouth inferior, transverse, and surrounded by a large sucker formed by both lips. Dorsal fin short, (7 branched rays) without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales of moderate size, none on the chest. Lateral line complete. ? *Northern India.*

3. *Discognathus*, 4 or 2 barbels. Mouth inferior, transverse and having a sucker on the lower lip only. Dorsal fin short (8 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales of moderate size. Lateral line complete. *Asia and part of Africa.*

4. *Labeo*, 4 or 2 or 0 barbels. Mouth anterior or even inferior, some with a lateral lobe to the snout : lips thick, one or both with an inner transverse fold, and mostly fringed, usually a horny covering to inside of lower lip. Dorsal fin of varying length (from 8 to 24 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales large, moderate, or of small size. • Lateral line complete. *Throughout Asia.*

5. *Osteochilus*, 4 or 2 barbels. Mouth nearly inferior ; lips thick, fringed, or crenulated, but the lower reflected from off the mandible, leaving it exposed as a sharp, transverse ridge. Dorsal fin of moderate length (from 10 to 20 branched rays), without osseous ray. Anal short, (5 to 6 branched rays). Pharyngeal teeth in 3 rows. Scales of moderate size. Lateral line complete. *Burma and E. I. Archipelago.*

6. *Cirrhitina*, 4, 2, or 0 barbels. Mouth broad, transverse, a knob inside symphysis of lower jaw, lips thin, upper one fringed or entire, edge of lower jaw sharp, with a thin lip and no horny

covering. Dorsal fin of varying length, (from 8 to 25 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales large, moderate, or of small size. Lateral line complete. *India, Burma and E. I. Archipelago.*

7. *Carassius*, 0 barbels. Mouth anterior, arched and rather narrow, lips thin. Dorsal fin moderately long (from 16 to 18 branched rays), its last undivided ray osseous and serrated. Anal fin short. Pharyngeal teeth in one row. Scales of moderate size. Lateral line complete. *Europe and Asia.*

8. *Semiplotus*, 0 barbels. Mouth wide, transverse, a knob inside symphysis of lower jaw, very slight motile powers in the upper jaw. Dorsal fin long (from 20 to 25 branched rays), its last undivided ray osseous and serrated. Anal short, (6 to 7 branched rays). Pharyngeal teeth in 3 rows. Scales large. Lateral line complete. *Assam and Akyab.*

9. *Catla*, 0 barbels. Mouth anterior, no upper lip ; a moveable articulation at symphysis of lower jaw, no tubercle. Dorsal fin moderately long (14 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales of moderate size. Lateral line complete. *From the Kistna throughout Bengal and Burma to Pegu.*

10. *Mola*, 0 barbels. Mouth rather wide, antero-lateral, with the lower jaw somewhat prominent. Dorsal fin short (5 to 9 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales small. Lateral line complete or incomplete. *India and Burma.*

11. *Barbus*, 4, 2, or 0 barbels. Mouth arched, closely invested by the lips, which may have leathery lobes, but no inner fold, or horny covering. Dorsal fin short (7 to 9 branched rays), its last undivided ray being either osseous and serrated, or entire, or else articulated. Anal short (5 to 6 branched rays), its second undivided ray may be osseous. Pharyngeal teeth in 3 rows. Scales of varying size. Lateral line complete or incomplete. *Asia, &c.*

12. *Schizothorax*, 4 barbels. Mouth arched, antero-inferior, mandibles neither broad nor flattened, usually a horny covering inside lower jaw. Dorsal fin rather short (7 to 9 branched rays), with its last undivided ray osseous and serrated. Anal short.

Pharyngeal teeth in 3 rows. Scales very small, the vent and base of anal fin in a sheath of tiled scales. Lateral line complete. *Mountain streams of Himalayas, Cashmere, Nepaul and Afghanistan.*

13. *Oreinus*, 4 barbels. Mouth transverse, inferior; mandibles, short, broad, flat and loosely joined together at the symphysis, usually a horny covering inside lower jaw. Dorsal fin short (7 to 8 branched rays), with its last undivided ray osseous and serrated. Anal short. Pharyngeal teeth in 3 rows. Scales very small, the vent and base of anal fin in a sheath of tiled scales. Lateral line complete. *Mountain streams of Himalayas, Cashmere, Nepaul and Afghanistan.*

14. *Schizopygopsis*, 0 barbels. Mouth inferior, transverse, narrow, a horny covering inside lower jaw, upper lip continuous with a short lateral one. Dorsal fin short (7 branched rays), with its last undivided ray serrated. Anal short. Pharyngeal teeth in 2 rows. Scales small, only a few present in the scapular region, the vent and base of anal fin in a sheath of tiled scales. Lateral line complete. *Tibet.*

15. *Diptychus*, 2 barbels. Mouth inferior, with a thick horny covering inside and on the front of the lower jaw, an uninterrupted labial fold across the mandible. Dorsal fin short (8 branched rays) without osseous ray. Anal short. Pharyngeal teeth in 2 rows. Scales small, only on sides of body and tail, the vent and base of anal fin in a sheath of tiled scales. Lateral line complete. *Tibet.*

16. *Ptychobarbus*, 2 barbels. Mouth arched, inferior. Dorsal fin short (8 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 2 rows. Scales small all over body, the vent and base of anal fin in a sheath of tiled scales. *Tibet.*

b. Dorsal fin commencing very distinctly posterior to the ventrals, but not extending to above the anal, which last is short, or of moderate length (5 to 10 branched rays).

17. *Nuria*, 4 barbels. Mouth narrow, directed obliquely upwards. Dorsal fin short (6 to 7 branched rays), without osseous ray. Anal short. Pharyngeal teeth in one row. Scales of moderate size. Lateral line complete or absent. *India, Ceylon, Burma.*

18. *Rasbora*, 2 or 0 barbels. Mouth oblique, lower jaws with

one central and two lateral prominences, fitting into emarginations in the upper jaw. Dorsal fin short (7 branched rays), without osseous ray. Anal short. Pharyngeal teeth in 3 rows. Scales large or of moderate size. Lateral line complete, rather concave. *India, Ceylon and Burma.*

19. *Aspidoparia*, 0 barbels. Mouth small, inferior, lower jaw without lip, having a sharp crescentic edge. Dorsal fin rather short, (7 to 8 branched rays) without osseous ray. Anal of moderate length (9 to 10 branched rays). Pharyngeal teeth in three rows. Scales of moderate size. Lateral line complete, rather concave. *From the Kistna throughout Bombay, Bengal and Burma.*

c. *Dorsal fin commencing in the interspace between the ventral and anal, generally extending to over the latter which is of moderate length or elongated (7 to 33 branched rays).*

20. *Rohtee*, 0 barbels. Mouth anterior. Dorsal fin rather short, (8 branched rays), with an osseous serrated ray. Anal elongated (13 to 33 branched rays). Pharyngeal teeth in 3 rows. Scales small. Lateral line complete. *From Kistna river throughout Bombay, Bengal and Burma.*

21. *Barilius*, 4, 2, or 0 barbels. Mouth anterior or oblique, cleft sometimes deep. Dorsal fin of moderate length (7 to 10 branched rays), without osseous ray. Anal rather elongated (7 to 14 branched rays). Pharyngeal teeth in three rows. Scales of moderate or small size. Lateral line, complete, incomplete or absent. When present concave. *India and Burma.*

22. *Danio*, 4, 2, or 0 barbels. Mouth narrow, directed obliquely upwards. Dorsal fin moderately elongated (9 to 14 branched rays), without osseous ray. Anal rather elongated (9 to 17 branched rays). Pharyngeal teeth in 3 rows. Scales of moderate size. Lateral line complete, concave. *India, Burma and Ceylon.*

B. *A portion or the whole of the abdominal edge trenchant.*

d. *Dorsal fin opposite the anal, which latter is elongated (9 to 21 branched rays).*

23. *Perilampus*, 0 barbels. Mouth directed obliquely upwards. Dorsal fin short or of moderate length (7 to 10 branched rays),

without osseous ray. Anal rather elongated, (15 to 21 branched rays). Pharyngeal teeth in 3 rows. Scales of moderate size. Lateral line complete, concave. *India, Burma and Ceylon.*

24. *Chela*, 0 barbels. Mouth directed obliquely upwards, with a strong knob at the symphysis. Dorsal fin moderately short (7 to 8 branched rays) without an osseous ray. Anal moderately short or elongated (9 to 19 branched rays). Pharyngeal teeth in 2 or 3 rows. Scales of moderate or small size. Lateral line complete or incomplete, concave. *India and Burma.*

I. GENUS *PSILORHYNCHUS*, McClelland, Pl. IX, fig. 1.

Back somewhat elevated, head moderately depressed: snout more or less spatulate. Mouth transverse, small, inferior. Lips entire, not continuous, reflected from off both jaws, and studded with glands. Barbels absent. Dorsal fin with few rays, commencing opposite the ventrals. Pectorals horizontal, with their outer rays unbranched. Anal short. Scales of moderate size, none on the chest. Lateral line complete, continued direct to the base of the caudal fin.

In removing this genus from the group HOMALOPTERINÆ, I must observe that I have only had the opportunity of examining one of the two known species, the *P. balitora*, H. Buch. apud McClelland, and it does not appear at all impossible that the other, *P. sucatio*, H. Buch., may be destitute of an air-bladder and would thus form a distinct genus appertaining to the sub-family HOMALOPTERINÆ.

Geographical distribution.—Hill streams and rivers in Bengal and Assam.

SYNOPSIS OF SPECIES.

1. *P. balitora*, D. $\frac{2}{7-8}$, A. $\frac{2}{5}$, L. 1. 33. Reddish brown irregularly marked with black. *N. E. Bengal and Assam.*

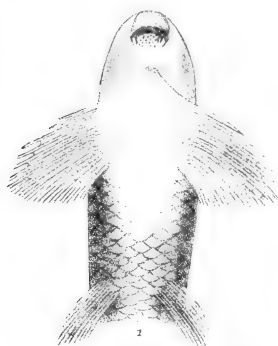
*2. *P. sucatio*, D. 9, A. 7, snout much produced. *N. E. Bengal.*

1. *PSILORHYNCHUS BALITORA*, Pl. IX, f. 1.

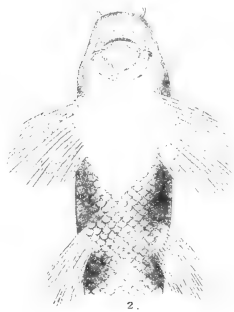
Cyprinus balitora, Ham. Buch., Fishes of Ganges, pp. 348, 394: *Cuv. and Val. Hist. Nat. des poissons, xvi, p. 451.

Psilorhynchus variegatus, McClelland, Ind. Cyp. pp. 300, 430, pl. 50, f. 2 (from H. B.'s MSS.).

Psilorhynchus balitora, Günther, Catal. vii, p. 343.



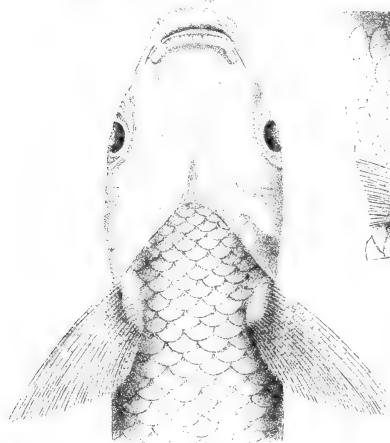
1.



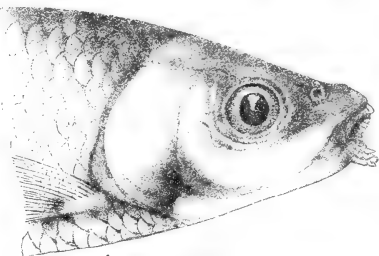
2.



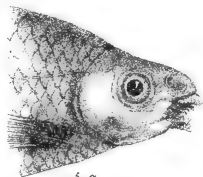
3.



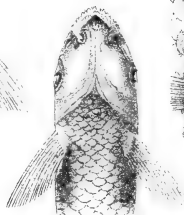
4. b.



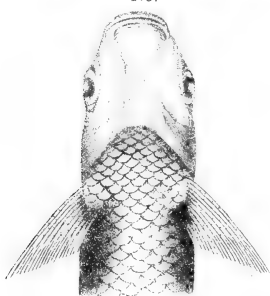
4. a.



5. a.



5. b.



6. b.



6. a.

1. *Psilorhynchus balitora*, p. 106.
2. *Maysa modesta*, p. 108.
3. *Ducegnathus lamta*, p. 109.

4. *Labeo rohita*, p. 111 & 120.
5. *Osteochilus Nilgh*, p. 129 & 130.
6. *Cirrhina mrigala*, p. 132 & 135.

B. III, D $\frac{2}{7-8}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 18, L. 1. 33, L. tr. $4\frac{1}{2}$ - $4\frac{1}{2}$.

Length of head nearly $\frac{1}{4}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{6}$, of dorsal fin $\frac{1}{6}$ of the total length.

Eyes.—Diameter rather above $\frac{1}{4}$ ($\frac{4}{17}$) of length of head : $1\frac{1}{4}$ diameters from end of snout and apart.

Head rounded, somewhat depressed. A deep cleft extending from the snout to the angle of the mouth. Lips rather thick and reflected from off either jaw which have sharp edges, but are destitute of any horny covering. Edges of lips not fringed, their surface covered with round hard pores. Some fine pores also on the cheeks, and snout.

Fins.—Dorsal commences in advance of the ventrals. Pectorals and ventrals nearly horizontal, the outer seven rays of the former, and two of the latter unbranched. Caudal forked.

Scales— $2\frac{1}{2}$ rows between the lateral line and base of the ventral fin.

Air bladder—rather large, divided by a constriction into an anterior and posterior portion, and not enclosed by bone.

Colours.—Reddish brown with irregular black blotches forming badly defined bands, in places passing over the back. Three bars on the caudal and some black on the anterior half of the dorsal.

Habitat.—Hill streams and rapids in N. E. Bengal and Assam.

2. **PSILORHYNCHUS SUCATIO.*

Cyprinus sucatio, Ham. Buch., Fish. Ganges, pp. 347, 393; *Cuv. and Val. XVI, p. 448.

Psilorhynchus sucatio, McClelland, Ind. Cyp., pp. 300, 429, pl. l. f. 1, (from H. B.'s MS.) ; Günther, Catal., vii, p. 343.

B. III, D. 9, P. 13, V. 9, A. 7, C. 16.

Snout much longer than the remainder of the head. The eyes are represented as large, but only stated to be far back and globular.

Fins.—Dorsal high, anteriorly with a very oblique upper margin.

Colours.—Superiorly greenish, with scattered dots ; sides clouded, abdomen whitish. Fins dotted.

Habitat.—Rivers of Northern Bengal, attaining about 3 inches in length.

II. Genus, MAYOA, Day. Pl. IX, f. 2.

Body anteriorly depressed, posteriorly compressed, snout rounded and smooth. Barbels four, two on the snout and one at each angle of the mouth. Eyes lateral. Mouth small, transverse, on the inferior surface of the head, and surrounded by a large sucker, formed of both lips, which are thick and have a free posterior edge. Pectorals and ventrals horizontal. Dorsal without an osseous ray, and commencing somewhat in advance of the ventrals. Pharyngeal teeth hooked, in three rows, 5, 3, 1-1, 3, 5. Scales of moderate size, none on the thorax. Lateral line continued direct to the centre of the base of the caudal fin.

SYNOPSIS OF SPECIES.

1. *Mayoa modesta*, D. $\frac{1}{7}$, A. $\frac{1}{5}$, L. l. 35. Habitat: probably Northern India.

1. MAYOA MODESTA.

Day, Pro. Zool. Soc. 1869, p. 553.

B. III. D. $\frac{1}{7}$, P. 15, V. 9, A. $\frac{1}{5}$, C. 19, L. l. 35, L. tr. $4\frac{1}{2}$ - $4\frac{1}{2}$.

Length of head nearly $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{11}$ of the total length.

Eyes—directed laterally upwards and outwards, placed near the upper surface of the head. Diameter $\frac{1}{4}$ of length of head, $1\frac{3}{4}$ diameters from end of snout, 2 diameters apart.

Head broad depressed, somewhat spatulate and rounded, as is also the snout. No pores on the head. Lower surface of head and chest flat. The snout overhangs the mouth, which is rather small, transverse, and nearly semilunar in shape. Mouth with an adhesive sucker, formed by both lips, and having a free margin, it is extended some distance posterior to the lower jaw as in the genus *Discognathus*, from which it essentially differs in that the sucker is completed by the upper lip, so as entirely surrounding the opening of the mouth. The lips are reflected from off both jaws and with a tuberculated surface: margin of upper lip fimbriated. Four barbels, one rostral and one maxillary pair, all being rather thick and short. Gill opening narrow.

Teeth—pharyngeal, uncinatè, 5, 3, 1-1, 3, 5.

Fins.—Pectorals and ventrals horizontal, the former extending to the latter, which reaches the anal. First outer pectoral ray simple,

the 4 next only slightly branched. Dorsal arises in advance of the ventral. Caudal slightly forked.

Scales—none on the chest.

Lateral line—proceeds direct to the base of the caudal fin.

Colours.—Greenish brown, no marks existing except a dark blotch under the dorsal fin and a mark at the base of the caudal.

Habitat.—Probably Northern India, 2 specimens in the Calcutta Museum, the longest $3\frac{1}{2}$ inches.

III. Genus, DISCOGNATHUS, *Heckel*. Pl. IX. f. 3.

Garra, Ham. Buch.—*Platyca*, McClelland.—*Discognathichthys*, et *Lissorhynchus*, Bleeker.

Body elongated, subcylindrical. *Mouth* transverse, semicircular, and inferior; upper and lower lips continuous: no lateral lobes to snout, which projects beyond the mouth. A suctorial disk on the chin, formed of the lower lip: upper lip fringed. *Barbels* four (*Garra*, Ham. Buch.) or one pair only at each angle of the mouth, (*Discognathus*, Heckel). *Pharyngeal teeth* uncinat and in three closely approximating rows 2, 4, 5-5, 4, 2. *Dorsal fin* with few rays, commencing slightly in advance of the ventrals, its base scaleless: *Pectoral* horizontal: *Anal* short. *Scales* of moderate size, no enlarged anal scales. *Lateral line* continued to the centre of the base of the caudal fin.

Geographical distribution.—Rivers, more especially mountain streams, of Asia and Abyssinia: extending throughout India, Ceylon and the Tennasserim Provinces.

SYNOPSIS OF SPECIES.

1. *Discognathus lamta*, D. 11, A. 7, L. l. 33—36, 4 barbels. A black spot behind gill opening and generally a band along the side. Throughout India, Ceylon and Tennasserim Provinces.

1. DISCOGNATHUS (GARRA) LAMTA.

Cyprinus lamta, Ham. Buch., Fish. Ganges, pp. 343, 393; *Cuv. and Val., xvi, p. 386.

Cyprinus gotyla, Gray and Hardwicke, Ind. Zool. c. fig., *Cuv. and Val., xvi, p. 387.

Gonorhynchus rupeculus, McClelland, pp. 281, 373, pl. 43, f. 4, 5; *Cuv. and Val. xvi, p. 467.

*Gonorrhynchus bimaculatus, brachypterus, et caudatus, McClell., loc. cit. pp. 281, 283, 373, 374, pl. 43, f. 2. (from H. B.'s MS.); *Cuv. and Val., xvi, pp. 414, 467.*

Platyacara nasuta, McClell., Journ. A. S. of B., vii, p. 947, t. 55, f. 2a. and b; and Ind. Cypr. pp. 300, 428, pl. 57, f. 2.

? *Platyacara lissorhynchus, McClell., Cal. J. N. H., ii, p. 587, pl. xvi, f. 2.*

Discognathus rufus, obtusus, crenulatus et fusiformis, Heckel, Russegger's Reisen, i, pp. 1071, 1072, t. 8, f. 2 and 3 and ii, p. 262 and iv, p. 387 c. fig.

Platyacara notata, Blyth, Journ. A. S. of B., 1860, p. 161.

Gonorrhynchus gotyla, McClellandi et stenorrhynchus, Jerdon, M. J. L. S., 1849, pp. 309, 310.

Garra Ceylonensis, Bleeker, Cobit. et Cyprin. Ceylon, p. 8, t. 1, f. 4.

Garra gotyla et lamta, Steind., Sitz. Ak. Wiss., Wien., lvi. t. 2.

,, *malabarica, Day, Proc. Zool. Soc. 1865, p. 297 and Fishes of Malabar, p. 205, pl. 15 f. 1.*

Garra gotyla, Day, Proc. Zool. Soc. 1867, p. 288 (snout covered with pores and having a deep depression across it).

Garra Jerdoni, Day, loc. cit. (snout smooth, neither pores nor depression).

Garra alta, Day, loc. cit. (Back elevated).

Discognathus lamta, Günther, Catal., vii, p. 69; Day, Pro. Zool. Soc. 1869, p. 554.

Discognathus macrochir, Günther, ibidem vii, p. 70.

Kul korava, Tam. "The stone Ophiocephalus, Pandi-pakke, Can." Korafi-kacli, Hind.

B. III, D. $\frac{3}{8}$, P. 15, V. 10, A. $\frac{2}{5}$, C. 17, L. 1. 32-36, L. tr. $4\frac{1}{2}$ -5.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{5}$ of the total length.

Eyes:—directed slightly upwards and outwards. Diameter $\frac{1}{5}$ of length of head; $3\frac{1}{2}$ diameters from end of snout: $2\frac{1}{2}$ diameters apart.

Snout very diversified, either smooth, or covered with pores, and having or not having a deep transverse depression.

Fins.—The dorsal arises midway between the snout and the base of the caudal, and anterior to the origin of the ventral. The pectoral extends to beneath the first third of the dorsal. Caudal lobed.

Colours.—Greenish, with a bluish green band along the centre of the body and extending along the middle of the caudal fin. Abdomen yellowish green. Fins yellowish, stained darker at their margins. In specimens from the Tennasserim Provinces a black spot exists at the base of each dorsal ray.

Habitat. From Syria throughout India and Ceylon to the Tennasserim Provinces, and likewise found in Abyssinia. It attains 6 inches in length.

IV. Genus—*LABEO*, Cuv. Pl. IX, f. 4 a. b.

Rohita, pt. Cuv. and Val.—*Tylognathus*, Heckel.—*Hypselobarbus*, *Diplocheilus*, *Diplocheilichthys*, *Lobocheilus*, *Rohitichthys*, *Morulius*, *Schismatorhynchus*, et *Gobionichthys*, Bleeker.

Body elliptical or moderately elongated, abdomen rounded, mouth sometimes anterior but mostly inferior, transverse and demi-oval. Lips thick, covering the jaws, one or both having an inner transverse fold. A soft and moveable horny covering with a sharp margin on the inner edge of one or both lips. Snout rounded, generally projecting beyond the mouth and covered with tubercles, and sometimes having a lateral lobe or projection. Barbels small, four or two: if only one pair, they are on the maxilla, the second being on the snout, or they may be absent. Pharyngeal teeth hooked and in three rows, 5, 4, 2 - 2, 4, 5. Dorsal fin elongated, or of moderate length, destitute of any osseous ray, and arising anterior to the commencement of the ventral. Anal short. Scales large, moderate, or of small size. Lateral line running along the median line of the tail. Gill rakers short.

Dr. Günther sub-divides this genus into *Labeo* in which the dorsal fin has "more than nine branched rays," whilst *Tylognathus* has "not more than nine branched rays"; his reason for this artificial division being because "by uniting these two genera, I should have been obliged to abandon the character of a long or short dorsal fin for the definition of other very natural genera of Cyprinoids."

Geographical distribution. Throughout the fresh waters of the plains of India, Ceylon and Burma.

SYNOPSIS OF SPECIES.

1. *Labeo nandina*, D. $\frac{2}{22-24}$, L. l. 41—44, L. tr. $7\frac{1}{2}/8$, 4 Barbels. *Assam and Bengal.*
2. „ *fimbriatus*, D. $\frac{4}{16-17}$, L. l. 44—47, L. tr. $\frac{9-10}{8-9}$, 4 barbels. *Southern India to Orissa, and in Kistna to the Deccan.*
- *3. „ *nancar*, D. $\frac{3}{17}$, 4 barbels. *N. E. part of Bengal.*
4. „ *calbasu*, D. $\frac{3}{14-15}$, L. l. 40—44, L. tr. $7\frac{1}{2}/9$, 4 barbels. *Throughout India and Burma.*
5. „ *curchius*, D. $\frac{2-3}{14}$, L. l. 64—80, L. tr. $\frac{14-15}{15}$, 4 barbels. *Orissa, Bengal and Burma.*
6. „ *kontius*, D. $\frac{4}{12}$, L. l. 38—40, L. tr. $9/8$, 4 barbels. *S. India.*
7. „ *nigrescens*, D. $\frac{2}{14}$, L. l. 36, L. tr. $6/7$, 4 barbels. *Canara.*
8. „ *Dussumieri*, D. $\frac{3}{12-13}$, L. l. 53—55, L. tr. $\frac{8-9}{9}$, 4 barbels. *Western coast of India and Ceylon.*
9. „ *roita*, D. $\frac{3}{12-13}$, L. l. 41, L. tr. $\frac{6\frac{1}{2}}{9}$, 4 barbels. *Orissa, Bengal and Burma.*
- *10. „ *moralæ*, D. $\frac{3}{10-11}$, L. l. 31 (?) 4 barbels. *Bengal.*
11. „ *Nashii*, D. $\frac{3}{11}$, L. l. 41, L. tr. $7\frac{1}{2}/6$. No barbels. A black lateral band. *Coorg.*
12. „ *ricnorhynchus*, D. $\frac{3}{16}$, L. l. 42—44, L. tr. $8/9$. One pair of maxillary barbels. *Bengal, Orissa, Himalayan, Nepaul and Afghan ranges.*
13. „ *falcatus*, D. $2/11$, L. l. 43, L. tr. $8\frac{1}{2}/7\frac{1}{2}$. One pair of maxillary barbels. *Bengal, Assam, Sikkim.*
- *14. „ *diplostomus*, D. 13, L. l. 45, L. tr. $8/7$. One pair of maxillary barbels. *Cashmere.*
15. „ *pangusia*, D. $3/10$, L. l. 40, L. tr. $7\frac{1}{2}/7$. One pair of maxillary barbels. *Bengal and Cachar.*
16. „ *striolatus*, D. $3/9$, L. l. 60, L. tr. $12/14$. One pair of maxillary barbels. *Central India.*

17. *Labeo bicolor*, D. 2/10, A. 2/5, L. l. 43, L. tr. $8\frac{1}{2}/7\frac{1}{2}$. One pair of barbels, colours uniform. N. W. Provinces.
- *18. „ *kawrus*, D. 12. Barbels absent. Deccan.
19. „ *ariza*, D. 3/9, L. l. 38—40, L. tr. $7\frac{1}{2}/7$. One pair of maxillary barbels, orange colour. Continent of India.
20. „ *boga*, D. 3/9, L. l. 40—42, L. tr. $\frac{7-8}{5}$. One pair of maxillary barbels. Silvery. India and Burma.
- *21. „ *mullya*, D. 11. Deccan.

1. LABEO NANDINA.

Cyprinus nandina, Ham. Buch., Fish. Ganges, pp. 300, 388, pl. 8, f. 84.

Cirrhinus nandina et macronotus, McClell., Ind. Cyp. pp. 265, 269, 318, 319, pl. 41, f. 1.

Rohita nandina, Cuv. and Val., XVI, p. 244, pl. 473.

Labeo nandina, Günther, Catal. VII, p. 51.

„ *macronotus*, Günther, loc. cit. VII, p. 52.

Nandin, Beng.

B. III. D. $\frac{2}{22-25}$, P. 15, V. 9, A. 2/5, C. 19, L. l. 41-44, L. tr. $7\frac{1}{2}/8$.

Length of head 2/9, of caudal 1/6, height of body 1/4 of the total length.

Eyes.—Diameter 1/5 of length of head, $1\frac{1}{2}$ diameters from end of snout.

Snout obtuse, slightly projecting beyond the jaws, no lateral lobe: a few fine pores on snout. Lips thick and fringed, with a distinct inner fold above and below. Four short barbels.

Fins.—This species forms with D. 26 *Labeo nandina*, and with D. 24 *Labeo macronotus*, which, however, I believe, Hamilton Buchanan was quite correct in considering as mere varieties. Dorsal fin low, caudal forked.

Lateral line.—From $4\frac{1}{2}$ to 5 rows of scales between it and the base of the ventral fin.

Colours.—Dark greenish above having a coppery gloss, and whitish below.

Habitat.—Bengal and Assam; it attains three feet in length.

McClelland observes of the variety with D. 26 (which he considered "a species") 'I think I have met with it in the Brahmaputra as high as Gowhati, but it disappears where the currents become rapid, and the water more cool and clear. Buchanan found it very abundantly in the marshes adjacent to the ruins of the ancient Gour, on the northern side of Bengal, where it usually attains two or three feet in length, and is a well flavoured and wholesome fish.' Of the second variety with D. 24 he remarks 'the individuals I met with in Assam in March were found in sandy streams which they had entered probably for the purpose of spawning. They are seldom seen so high in the Brahmaputra as the rapids, and never, I believe, so low as to come within the influence of the tides, which effect a change by the deposit of mud instead of sand, no less remarkable in the bottoms and banks of rivers, than in the character of the fresh water-fishes, which are found within their influence,' (p. 319.)

2. LABEO FIMBRIATUS.

Cyprinus fimbriatus, Bloch, XII, p. 50, pl. 409.

Rohita fimbriata, Cuv. and Val., XVI, p. 271.

Rohita Leschenaultii, Cuv. and Val., XVI, 261.

Varicorhinus bobree, Sykes, Trans. Z. S. II, p. 355, pl. 61, f. 3.

Cirrhinus fimbriatus,* Jerdon, M. J. L. and S., 1849, p. 304.

Cirrhinus Leschenaultii,* Jerdon, loc. cit. p. 305.

Labeo fimbriatus, Günther, Catal., VII, p. 53.

Labeo Leschenaultii, Günther, Catal., VII, p. 53.

Ven-candee, Tam.; *Ruchu* and *Gandumenu*, Tel.; *Bahrum*, Ooriah;

B. III. D. $\frac{4}{16-17}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 44-47, L. tr. 9-10/8-9.

Length of head $\frac{2}{13}$, of caudal $\frac{1}{4}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{2}{11}$ of the total length.

Eyes.—Diameter $\frac{1}{5}$ of length of head; $1\frac{1}{2}$ diameters from end of snout; 2 diameters apart.

Snout obtuse, rather swollen and studded with minute pores, but destitute of a lateral lobe. Mouth transverse, and of moderate width, lips thick, continuous and having an inner fold above and below, both fringed. A groove across the chin. Rostral and maxillary barbels short.

Teeth—pharyngeal, 5, 3, 2 - 2, 3, 5.

Fins.—Dorsal fin commences opposite about the 15th scale of the lateral line, its upper margin is concave. Caudal forked.

Lateral line;—6 to 7 rows of scales between it and the base of the ventral fin.

Colours.—Uniform, nearly black.

Habitat.—Throughout the coasts of Southern India up to Orissa. Also in the Kistna as high as Kurnool. It attains a foot and a half in length, and is good eating, but bony.

3. **LABEO NANCAR.*

Cyprinus nancar, Ham. Buch., Fishes of Ganges, pp. 299, 387.
*Cuv. and Val. XVI, p. 70.

Cirrhinus nancar, *McClelland, Ind. Cyp. pp. 266, 325.

B. III. D. 3/17, P. 18, V. 9, A. 8, C. 20.

"The head is small, blunt, and oval * * the nose projects a little beyond the mouth, and is fleshy and bluntish * * with no tubercles nor large pores. * * The mouth is low, extends straight back, and is small. The jaws protrude in opening and are nearly equal in length * * the lips are fleshy, the under one is erect * * the edges of the lips smooth * * with four minute tendrils."

Eyes.—"high, circular, and of moderate size."

Fins.—"The dorsal is behind the middle. . . The tail fin consists of two sharp lobes."

Lateral line—"descends with a curve."

Scales—"large, equal."

Colours—"above of a dark green, with a golden gloss and below white. The fins are dark coloured, and the eyes reddish."

Habitat.—"The small rivers of the Gorakhpur district, such as the Gunggi. It does not attain a greater weight than three pounds."

Whether this fish belongs to the genus *Labeo* is questionable. McClelland did not obtain it, whilst Hamilton Buchanan left no figure of it; but as he places it between the *Labeo calbasu* and *Labeo nandina*, I have, though with considerable doubt, referred it to this genus.

4. LABEO CALBASU.

- Cyprinus calbasu*, Ham. Buch., Fish. G., pp. 297, 387, pl. 2, f. 83.
Cirrhinus calbasu, McClelland, Ind. Cyp., pp. 265, 320.
Cirrhina micropogon, Val. in Bél. Voy. Ind. Orient. p. 372, t. 3, f. 3.
Rohita calbosu, *Cuv. and Val. XVI, p. 253 ; Bleeker, Verh. Bat. Gen. XXV. Beng. and Hind. p. 131.
Rohita Belangeri, Cuv. and Val., XVI. p. 255 ; Bleeker, l. c. p. 132.
Rohita Reynauldi, Cuv. and Val., XVI, p. 247, pl. 474.
Labeo velatus, Val. in Cuv. Reg. An. III. Poiss. pl. 93, f. 3.
Cirrhinus affinis, Jerdon, M. J. L. and S., 1849, p. 303.
? *Tylognathus porcellus*, Heckel in Hügels Kaschmir, IV, p. 385.
Labeo calbasu et porcellus, Günther, Catal. VII, p. 54 ; Day, Proc. Zool. Soc. 1869, p. 372.

Nulla-gandu-menu, Telugu ; *kalbasu* and *kunda*, Beng. ; *Kala-beinse*, Ooriah ; *Nga-nek-pya*, *Nga-noo-than*, and *Nga-ong-tong*, Burmese.

B. III. D. $\frac{3}{14-15}$, P. 19, V. 9, A. 2/5, C. 19, L. 1. 40-44, L. tr. $7\frac{1}{2}/9$.

Length of head $1/6$, of caudal $1/5$, height of the body $1/4$, of dorsal fin $1/6$ of the total length.

Eyes.—Diameter $1/5$ of length of head, $1\frac{1}{2}$ to 2 diameters from end of snout, $2\frac{1}{2}$ apart.

Mouth of moderate width, snout obtuse and depressed, with pores on it, but without any lateral lobe. Lips thick, fringed, with a distinct inner fold to each. Barbels four, the rostral slightly the longest, and about equal in length to the diameter of the orbit.

Teeth, pharyngeal, crooked, 5, 4, 2 - 2, 4, 5.

Fins.—Dorsal commences in advance of the ventrals, its upper margin somewhat concave. Caudal deeply forked.

Lateral line :— $5\frac{1}{2}$ to 6 rows of scales between it and the base of the ventral fin.

Colours.—Blackish, sometimes many of the scales have a scarlet centre. Fins black, occasionally the end of the upper lobe of the caudal white.

Habitat.—Southern India, from the Kistna through Orissa, Bengal, and Burma. It grows to 3 feet in length ; were it not for its numerous bones, it would be excellent eating.

5. LABEO CURCHIUS.

Cyprinus curchius, *cursa*, *cursis*, et *gonius*, Ham. Buch., Fishes of Ganges, pp. 289, 290, 292, 387.

Cirrhinus gonius, McClelland, Ind. Cyp., pp. 266, 325.

Cyprinus (Labeo) curchius et cursis, McClelland, Ind. Cyp., pp. 268, 327, 329, pl. 40, f. 3, pl. 38, f. 2 and 3.

Rohita gonius et cursis, *Cuv. and Val., XVI, p. 259 and p. 265.

Labeo microlepidotus, Cuv. and Val., XVI, p. 352; Günther, Catal. VII, p. 60.

Rohita chalybeata, Cuv. and Val. XVI, p. 271; Bleeker, Ver. Bat. Gen. XXV, Beng. and Hind. p. 133.

Rohita microlepidota, Günther, Proc. Zool. Soc. 1861, p. 225.

Labeo Dussumieri, Cuv. and Val., XVI, p. 59 *? Günther, Catal. VII, p. 59.

Labeo cursa, *Cuv. and Val., XVI, p. 361; Günther, l. c. p. 60.

Labeo curchius, *Cuv. and Val., XVI, p. 363.

Labeo gonius, Day, Proc. Zool. Soc. 1869, p. 372.

Mosoo, Tel.; *Cursua*, Oorlah; *Kurchi* and *Goni*, Beng.; *Courie*. Assam: *Nga-pay*, Tennass.; *Nga-dane* and *Nga-hoo*, Burmese.

B. III. D. $\frac{2-3}{14}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 64—80,
L. tr. $\frac{14-15}{16}$.

Length of head $\frac{2}{11}$, of caudal $\frac{2}{11}$, height of body $\frac{1}{4}$, of dorsal fin $\frac{2}{11}$ of the total length.

Eyes.—Diameter $\frac{2}{9}$ of length of head, $1\frac{1}{2}$ diameters from end of snout, $2\frac{1}{2}$ diameters apart.

Mouth anterior and rather narrow; snout slightly swollen, without lateral lobe, but with fine pores. Lips rather thick with a distinct inner fold above and below, whilst both are finely fringed. Rostral and maxillary barbels all short, but the latter the longest.

Teeth, pharyngeal, with rather flat crowns 5, 4, 2 - 2, 4, 5.

Fins.—Dorsal commences much nearer to the end of the snout than to the base of the caudal fin, and rather anterior to the ventral. Caudal deeply forked.

Scales—small, the number in the lateral line subject to great variation.

Lateral line:—10 to 12 rows between it and the base of the ventral fin.

Colours.—Greyish, scales darkest at their margins.

Habitat.—From the Kistna river through Orissa, Bengal and Burma. It attains nearly 5 feet in length, but is rather indifferent eating.

6. LABEO KONTIUS.

Cyprinus kontius, Jerdon, M. J. L. and S., 1849, p. 302.

Cirrhinus rubro-punctatus, Jerdon, loc. cit. p. 303.

Labeo kontius, Day, Proc. Zool. Soc. 1867, p. 289, *Günther, Catal.; VII, p. 55.

Currumunnee candee, Tam.

B. III. D. 4/12, P. 15, V. 10, A. 3/5 C. 19, L. 1. 38—40, L. tr. 9/8.

Length of head $1/6$ to $1/7$, of caudal nearly $2/9$, height of body $1/4$, of dorsal fin above $1/5$ of the total length.

Eyes.—Diameter nearly $1/5$ of length of head; $2\frac{1}{2}$ to 3 diameters from end of snout; $2\frac{1}{4}$ diameters apart.

Dorsal profile more convex than the abdominal. Muzzle blunt, truncated, covered with pores, and having a fleshy lateral prolongation. Lips thick, with a distinct inner fold below, whilst the lower one is fringed. Snout overhanging the mouth. Opercles narrow. Four short barbels.

Teeth, pharyngeal, plough shaped, 5, 4, 2 - 2, 4, 5.

Fins.—Dorsal commences above the ventral and nearer the snout than the base of the caudal; its upper margin is slightly concave. Caudal deeply lunated.

Lateral line:—5 rows of scales between it and the base of the ventral.

Colours.—A general reddish or fleshy tinge, darkest along the back. In most of the specimens obtained from the Coleroon river, each scale had a red centre.

Habitat.—Rivers along the base of the Neilgherries, and the Cauvery and Coleroon in all their branches down to the coast. It grows to 2 feet in length.

7. LABEO NIGRESCENS.

Day, Proc. Zool. Soc. 1870.

B. III. D. 2/14, P. 15, V. 9, A. 2/5, C. 21, L. 1. 36, L. tr. 6/7.

Length of head $\frac{1}{3}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{7}$ of the total length.

Eyes.—Diameter $\frac{1}{5}$ of length of head, 2 diameters from the end of snout.

Snout rather swollen and rounded, and somewhat projecting over the lower jaw ; a small lateral lobe ; glands over the whole of the snout. A very distinct labial fold both above and below : a deep transverse groove across the chin ; lower lip deeply fringed. The rostral barbels reach to beneath the anterior margin of the orbit ; the maxillary to below its posterior third.

Fins.—Upper margin of dorsal fin straight ; the pectoral extends to the ventral, which latter fin reaches the anal. Anal rather elongated anteriorly, and if laid backwards it reaches the base of the caudal, which latter fin is deeply forked.

Scales.—Four and a half rows between the lateral line and base of the ventral fin.

Colours.—Deep brown, each scale with a black spot at its base. Fins black.

Habitat.—Mangalore.

8. LABEO DUSSUMIERI.

Rohita Dussumieri, Cuv. and Val., XVI, p. 258, pl. 475 ; Day, *Fishes of Malabar*, p. 207.

? *Rohita Rouxii*, Cuv. and Val. XVI, p. 270.

Cirrhinus Dussumieri, *Jerdon, M. J. L. and S. 1849, p. 304.

Labeo Dussumieri, Günther, Catal. VII, p. 59.

„ *Rouxii*, *Günther, l. c. p. 55.

Toolee, Mal.

B. III. D. $\frac{3}{12-13}$, P. 17, V. 9, A. $\frac{2-3}{5}$, C. 19, L. l. 53-55, L. tr. 8-9/9.

Length of head nearly $\frac{1}{7}$, of caudal $\frac{1}{6}$, height of body above $\frac{1}{5}$, of dorsal fin $\frac{1}{9}$ of the total length.

Eyes :—diameter $\frac{1}{4}$ of length of head, 1 diameter from end of snout, and 2 diameters apart.

Body elongated and compressed, the abdominal profile rather more convex than the dorsal.

Mouth of moderate width and somewhat inferior, surrounded by fleshy, fringed lips, having a distinct inner fold above and below, but no lateral lobe. Numerous pores on the lips and snout, extending posteriorly as far as the orbits, and below the nostrils. Barbels four, minute.

Fins.—Dorsal commences somewhat in advance of the ventrals, its upper edge being concave. Caudal deeply forked.

Lateral line:—5 rows of scales between it and the base of the ventral fin.

Colours.—Greyish, lightest beneath, scales edged with a darker shade. A dull diffused dark spot on either side of the tail. Fins dusky.

Habitat.—Rivers of south Malabar, Ceylon and perhaps Bombay.

It grows to about 13 inches in length.

The *Labeo Rouxii* comes from Bombay; it is said to have 46 scales only along the lateral line and to resemble *L. gonius* (= *L. curchius*), but the dorsal profile to be more elevated, the mouth more pointed and the caudal more forked.

9. LABEO ROHITA, Pl. IX, f. 4 a. b.

Cyprinus rohita, Ham. Buch., Fish. Ganges, pp. 301, 388, pl. 36, f. 85; McClelland, Ind. Cyp. pp. 266, 321, pl. 41, f. 2.

Rohita Buchanani, Cuv. and Val., XVI, p. 251; Bleeker, Verh. Bat. Gen. XXV, 1853, Hind. and Beng. p. 133.

Labeo fimbriatus, Cuv. and Val. XVI, p. 353.

Rohita Bengaliensis, and *Valenciennesi*, Bleeker.

Labeo Reynauldi, C. and V. XVI, p. 351.

Labeo Dussumieri, C. V. XVI, p. 350.

Labeo rohita, Günther, Catal. VII, p. 55.

Ruhu, Oorlah; *Rucee*, Beng.; *Nga-myt-chin*, and *Nga-myt-taan-nee* Burmese.

B. III. D. $\frac{3}{12-13}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. l. 41, L. tr. $\frac{6\frac{1}{2}}{9}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{1}{7}$ of the total length.

Eyes:—diameter $\frac{2}{9}$ of length of head; $1\frac{3}{4}$ diameters from end of snout; 3 diameters apart.

Profile of back more convex than that of the abdomen. Body moderately compressed. Mouth of moderate width, anterior. Snout obtuse, depressed, not swollen, but slightly projecting beyond the lower jaw: no lateral lobe: lips rather thick, fringed, and with a distinct inner fold above and below. Maxillary barbels thin and short: the rostral arc said to be sometimes present.

Teeth, pharyngeal, plough shaped, 5, 4, 3 - 3, 4, 5.

Fins.—Dorsal arises some distance in advance of the ventrals, its upper edge is slightly concave. Caudal lunate.

Lateral line :— $6\frac{1}{2}$ rows between it and the base of the ventral fin.

Colours—uniform.

Habitat.—Fresh-waters from Orissa through India to Burma, attaining three feet in length.

Hamilton Buchanan observes that it is perhaps the most excellent and valuable of all the fresh water fishes of Bengal, where it is propagated with considerable care, but he considered those which are taken in the small and rapid rivers, by far the best for eating. McClelland also remarks that there are several varieties, no doubt the result of domestication.

10. **LABEO MORALA.*

Cyprinus morala, Ham. Buch. Fish. Ganges, pp. 331, 391, pl. 18, f. 91 ; *McClell. Ind. Cyp. pp. 267, 326 ; Gray and Hardwicke, Ill. Ind. Zool.

Cyprinus pausius, Ham. Buch., l. c. pp. 332, 392.

„ *musiha*, Ham. Buch., l. c. pp. 332, 392, *Cuv. and Val. XVI, p. 439.

Rohita morala, *Cuv. and Val. XVI, p. 263.

Labeo morala, Günther, Catal. VII. p. 56.

Morala, Beng.

B. III. D. $\frac{3}{10-11}$, P. 16, V. 9, A. $\frac{3}{5}$, C. 19, L. l. 31 (in figure).

Length of head $\frac{1}{4}$, height of body $\frac{1}{4}$ of the entire length, according to the figure.

Eyes :—“ High flat and of moderate size ;” in the figure they are situated rather posterior to the centre of the length of the head.

The lips are thick, the lower one being fringed. The *C. morala* and *C. pausius* are stated to have “ minute” barbels. Dr. Günther says they are “ about as long as the eye,” but as he does not appear ever to have seen the species, his description is probably inaccurate, being taken from the figure in which they disagree with the text. Hamilton Buchanan also observes of the *C. musiha* that “ it differs from the description of the *morala* in nothing but the want of tendrils, and those of the *morala* are so minute, that I have some doubts of their being a sufficient mark of distinction.” (p. 333).

Fins.—“ The dorsal is before the middle and its edge forms a

concave curve, * * the pectoral fins are shorter than the head." Caudal lobed.

Colours.—Superiorly brownish green with many dark dots, whilst inferiorly it is silvery. Head dotted on the nose.

Habitat.—Bengal, in the Kosi river termed *Paungsi*, in the Ganges at Patna, *musika*. It is said to attain the size of a small herring.

Cyprinus angra H. B. pp. 331, 391; C. (*Bangana*) *Hamiltonii*, Gray and Hard.; *Gobio angra* McClelland, pp. 277, 354; *Cuv. and Val. XVI, p. 319; the Lasseem of the Assamese, is said to differ from the above in having two barbels and a broad longitudinal dark dotted stripe. It is found in the Brahmaputra river, but McClelland observes it has D. 10, L. 1. 35, L. tr. 14 to base of ventral fin; the specimen, from which his description was drawn up, was apparently very similar to his *Gobio isurus*.

11. LABEO NASHII.

Barbus Nashii, Day, Pro. Zool. Soc. 1868, p. 584.

B. III. D. 3/11, P. 15, A. 3/5, C. 19, L. 1. 41, L. tr. 7½/6.

Length of head 1/5, of caudal 2/9, height of body 1/5, of dorsal fin 1/6 of the total length.

Eyes:—Diameter 1/3 of length of head; 1 diameter from end of snout; 1½ diameters apart.

Mouth antero-inferior, the snout slightly projecting, but having no pores, tubercles, nor lateral lobe. Lips not fringed, but there is a slight thickening on the jaws, not horny, but of a dark colour. No barbels.

Teeth, pharyngeal, crooked, sharp, 5, 4, 3/3, 4, 5.

Fins.—Dorsal destitute of any osseous ray, commences anterior to the ventrals, its upper margin is concave; caudal forked.

Lateral line—proceeds to the centre of the base of the caudal; 4½ rows of scales between it and the base of the ventral.

Colours.—Reddish brown along the back, abdomen silvery. A black band passes from the eye to the centre of the caudal fin. A dark band along the middle third of the dorsal, and a dark edging to the caudal.

Habitat.—Fraserpett at the foot of the Coorg Hills. It was sent

to me by Dr. Nash after whom I have named it. It attains 4 inches in length.

12. LABEO RICNORHYNCHUS.

? *Cyprinus musiha*, Ham. Buch., pp. 333, 392.

Gobio ricnorhynchus, McClelland, Ind. Cyp., pp. 279, 363, pl. 55, f. 1; *Cuv. and Val. XVI, p. 464.

Labeo ricnorhynchus, Günther, Catal. VII, p. 57; Day Proc. Zool. Soc. 1869, p. 373.

Nepura, Assamese; *Kul-ka-batta* Bengali.

B. III. D. $\frac{3}{10}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. l. 42—44, L. tr. $\frac{8}{9}$.

Length of head $\frac{1}{6}$, of caudal $\frac{2}{9}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{2}{7}$ of the total length.

Eyes:—diameter $\frac{1}{5}$ of length of head; 2 diameters from end of snout and apart.

Body moderately compressed, dorsal and abdominal profiles about equally convex.

Mouth broad, directed downwards, when the upper jaw is protruded; snout overhanging the jaws and having a well developed lateral lobe. Lips rather thick and continuous, with an inner fold in their entire circumference, but most developed in the lower lip which also is fringed. Snout with a deep transverse depression posterior to it, dividing the mucous pores on it from those on the forehead. Two very small maxillary barbels.

Teeth, pharyngeal, plough shaped 5, 4, $\frac{2}{2}$, 4, 5.

Fins.—Dorsal with its upper margin concave, its anterior rays being produced; it arises midway between the end of the snout and base of the caudal. Caudal deeply forked, lower lobe the longest.

Lateral line:—6 to $6\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours.—Greyish, darkest along the back, each scale tinged with red. Fins with a reddish tinge. The outer edge of the dorsal rather stained.

Habitat:—Cossye river and the Himalayan and Nepaul regions, as well as Assam and Afghanistan.

The *Cyprinus potail*, Sykes, p. 354, may possibly belong to this species.

13. LABEO FALCATUS.

Cyprinus (Bangana) falcata, Gray and Hard. Ind. Zool.

Gobio malacostomus, McClelland, Ind. Cyp., p. 280.

Labeo malacostomus, Cuv. and Val., XVI, p. 365.

Labeo falcatus, Günther, Catal. VII, p. 58.

B. III. D. 2/11, P. 17, V. 9, A. 2/5, C. 19, L. l. 43, L. tr. $8\frac{1}{2}/7\frac{1}{2}$.

Length of head 2/11, of caudal 2/11, height of body 2/9 of the total length.

Eyes:—diameter 1/6 of length of head, 3 diameters from end of snout ; 2 diameters apart.

Snout obtuse, projecting, with a distinct lateral lobe, mouth broad, directed downwards when the upper jaw is protruded. A distinct inner fold in the entire circumference of both lips, the lower of which is the thickest. One pair of short maxillary barbels.

Fins.—Dorsal commences midway between the end of the snout and the posterior end of the base of the anal fin, its upper margin concave. Caudal deeply forked, its lower lobe the longest

Lateral line:— $4\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Habitat.—Bengal, Assam and Sikkim. It attains three feet in length.

14. *LABEO DIPLOSTOMUS.

Varicorhinus diplostomus, Heck., Fish. Caschmir, p. 67, t. 11.

Labeo diplostomus, *Cuv. and Val., XVI, p. 360 ; *Günther, Catal. VII, p. 57.

Tylognathus Valenciennesii, Heckel, in Hugel's Reise &c., IV, p. 378 and in Russeggers Reisen, II, 3, p. 283 (no description).

B. III. D. 13, P. 8 (?) V. 10, A. 8, C. 17, L. l. 45, L. tr. 8/7.

Length of head 1/6, height of body 1/5 of the total length.

Eyes—small, situated before middle, of the length of the head.

Snout obtuse, projecting over the mouth and having a small lateral lobe. Some pores on the snout, mouth broad : lips thick, continuous, with an inner fold in their entire extent, but most developed on the lower lip which also is fringed. Two small maxillary barbels.

Fins.—In the single individual of 9 inches in length the upper

margin of the dorsal appears a little convex (?) ; caudal slightly forked.

Lateral line :—7 (?) rows between it and the base of the ventral fin.

Colours :—Uniform.

Habitat :—Cashmere.

My opinion is that the above is the *Labeo ricnorhynchus*, McClelland, but unable to obtain a Cashmorean example, I have left it as a doubtful species ; the following appear to be the chief points of reputed differences between the two :

Labeo diplostomus—eyes situated before the middle of the length of the head, caudal fin slightly forked, the length of the middle rays being one half of that of the longest outer ones.

Labeo ricnorhynchus—eyes situated in or a little behind the middle of the length of the head, caudal fin deeply forked, the length of middle rays being two-sevenths of that of the longest outer ones.

15. LABEO PANGUSIA.

Cyprinus pangusia, Ham. Buch., Fishes of Ganges, pp. 285, 386 ; *Cuv. and Val. XVI, p. 429.

Gobio pangusia, McClell., Ind. Cyp., pp. 279, 362, pl. 42, f. 1, (from H. B.'s MS.)

Labeo pangusia, Günther, Catal. VII, p. 58.

B. III. D. $\frac{3}{10}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 40, L. tr. $7\frac{1}{2}/7$.

Length of head $\frac{2}{11}$, height of body $\frac{2}{9}$, length of caudal $\frac{1}{5}$ of the total length.

Eyes :—diameter $\frac{2}{7}$ of length of head, $1\frac{1}{2}$ diameters from end of snout.

Body rather compressed. Mouth narrow, snout with some large pores on its anterior surface ; it is obtuse anteriorly, projecting over the jaws, and has a distinct lobe on either side. Lips rather thick, with a distinct inner fold in their entire circumference, but no fringe. One pair of small maxillary barbels.

Fins.—Upper margin of dorsal fin concave. Caudal deeply forked.

Lateral line :— $4\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours :—Uniform.

Habitat.—Bengal and Cachar. Attains 8 inches in length.

16. LABEO STRIOLATUS.

Tylognathus striolatus, Günther, Catal. VII, p. 62.

B. III. D. 3/9, P. 17, V. 9, A 2/5, C. 19, L. 1. 60, L. tr. 12/14.

Length of head 2/11, height of body 2/5 of the total length.

Eyes:—diameter $\frac{1}{3}$ of length of head, $1\frac{3}{4}$ diameters from end of snout, 2 diameters apart.

Snout thick and somewhat projecting beyond the lower jaw, but without any lateral lobe. Interorbital space convex. A moderately sized maxillary, but no rostral barbels.

Fins.—The dorsal commences somewhat in advance of the ventral and nearer to the end of the snout than to the root of the caudal.

Lateral line:—9 rows of scales between it and the base of the ventral fin.

Colours:—Silvery, darkest above.

Habitat.—Poona, Nagpore.

The *Cyprinus joalius* and *pausio* H. B. pp. 316, 317, 389; McClelland, Ind. Cyp., pp. 267, 327, pl. 42, f. 6, (from H. B.'s MS.); *Cuv. and Val. XVI, pp. 264, 401; appear probably to belong to this species, only Buchanan states that it has a black crescent shaped mark on either side of the tail. It comes from N. E. Bengal.

17. LABEO BICOLOR.

Gobio bicolor, McClelland, Ind. Cyp., pp. 278, 360, t. 40, f. 1.

Gymnostomus bicolor,* Günther, Catal. VII, p. 374.

B. III. D. 2/10, P. 18, V. 9, A. 2/5, C. 19, L. 1. 43, L. tr. $8\frac{1}{2}/7\frac{1}{2}$.

Length of head 1/6, of caudal 1/5, height of body 1/5 of the total length.

Eyes:—diameter 2/7 of length of head, $1\frac{3}{4}$ diameters from end of snout, 2 diameters apart.

Snout overhanging the mouth, but not swollen, a small lateral lobe. A few indistinct pores between eye and snout. Lips continuous, with an indistinct inner fold to the upper, but distinct to the lower lip which is thick, reflected away from the lower jaw and covered internally with papillæ; mouth transverse, inferior. A horny covering to inside of lower jaw. A pair of short barbels to the maxilla.

Fins.—The height of the dorsal fin equals the length of the head, its upper margin is very concave, it commences before the ventrals and midway between the snout and the posterior extremity of the base of the anal fin. Caudal deeply forked, lower lobe the shortest.

Teeth, pharyngeal, plough-shaped 5, 4, 2/2, 4, 5.

Scales:— $7\frac{1}{2}$ rows between the lateral line and the base of the ventral fin.

Colours:—silvery, darkest in the upper half of the body; sometimes the scales are spotted with red.

Habitat.—N. W. Provinces, and Assam in clear streams. It is termed *Mohaylee* and *Gaywah* in Hindoostanee at Hurdwar and Saharunpore.

It appears to strongly resemble *Gobio anisurus*, McClelland, which, however, is said to have 39 scales in the lateral line, a rough porous snout, and the lower lobe of the caudal to be the longest; see *Cirrhitina anisura*, p. 136.

18. *LABEO KAWRUS.

Chondrostoma kawrus, Sykes, Trans. Zool. Soc., II, p. 358, pl. 62, f. 2.

B. III. D. 12, P. 16, V. 9, A. 8, C. 19.

Height of body above $\frac{1}{4}$ ($\frac{3}{13}$) of the total length.

Judging from the figure, the eye is in the posterior half of the head. The snout overhangs the mouth. It is said to have no tubercles or barbels.

Fins.—Dorsal arises in advance of the ventral. Caudal forked.

Lateral line—badly marked.

Colours.—Back reddish-green grey, silvery below. Fins with the extremity of the rays tinted reddish.

Habitat.—Beema river at Seedataik, attaining a foot in length.

19. LABEO ARIZA.

Cyprinus ariza, Buchanan's journey through Mysore, III, p. 344; pl. 31, and Fish. Ganges, pp. 286, 386. *McClell., Ind. Cyp., pp. 279, 357. *Cuv. and Val., XVI, p. 430.

Gobio Hamiltonii et bovanus, Jerdon, M. J. L. and S., 1849, p. 307.

? *Chondrostoma semivelatus*, Cuv. and Val., XVII, p. 402; *Günther, Catal., VII, p. 76.

Tylognathus ariza, Günther, Catal., VII, p. 63.

Kinda-meen, and *Coal-arinza-candee*, Tam.; *Ariza*, Tel.; *Bangumbatta*, Beng.

B. III. D. $\frac{3}{9}$, P. 18, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 38—40, L. tr. $7\frac{1}{2}/7$, Vert. 17/15.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{4}$, height of body $\frac{2}{9}$ of the total length.

Eyes:—diameter $\frac{1}{4}$ to $\frac{1}{5}$ of length of head, $1\frac{1}{4}$ diameters from end of snout, $1\frac{1}{3}$ diameters apart.

Snout moderately projecting beyond the jaws, lateral lobe not developed; lips rather thick, the lower being slightly fringed. Snout occasionally covered with large mucous pores. Two minute maxillary barbels.

Teeth, pharyngeal, 5, 4, $\frac{3}{3}$, 4, 5, plough-shaped.

Fins.—Origin of dorsal considerably in advance of the ventrals, nearer the snout than the base of the caudal, upper margin concave; caudal deeply lobed.

Lateral line:—5 rows of scales between it and the base of the ventral fin.

Colours.—Orange, with the fins of a reddish tinge.

Habitat.—Rivers of India. Said to attain a foot in length, also found near Calcutta.

20. LABEO BOGA.

Cyprinus boga, Ham. Buch., Fish. Ganges, pp. 286, 386, pl. 28, f. 80, *Cuv. and Val., XVI, p. 432.

Gobio boga, McClell., Ind. Cyp., pp. 278, 361; Bleeker, Verh. Bat. Gen. XXVI, Beng. and Hind. p. 134.

Gobio augraoides, Jerdon, M. J. L. and S., 1849, p. 307.

Tylognathus boga, Günther, Catal., VII, p. 64.

B. III. D. $\frac{3}{9}$, P. 19, V. 9, A. $\frac{2}{5}$, C. 21, L. 1. 40—42, L. tr. 7-8/5.

This fish is similar to *L. ariza* of which it might be considered a variety; but both are found in Southern India in the same localities; and the colour alone at once demonstrates the species when in a fresh state.

The lateral lobe to the snout may be slightly more apparent in this species and the eye is slightly behind the middle of the length of the head.

Colours:—silvery. At Mandalay the specimens had a distinct black mark at the posterior end of the lateral line.

Habitat.—Fresh waters of India and Burma.

The *Chondrostoma Duvaucellii*, Cuv. and Val., may be identical with the present species.

21. *LABEO MULLYA.

Chondrostoma mullya, Sykes, Trans. Zool. Soc., II, p. 359, pl. 62, f. 3.

Gymnostomus mullya, *Günther, Catal., VII, p. 76.

B. III. D. 11, P. 16, V. 9, A. 8, C. 19.

Body subcylindrical, head short, obtuse, snout projecting.

Fins.—Dorsal situated a little before the centre of the fish, and slightly before the ventral. Caudal lunate.

Colours.—Some carmine spots about the head, general colour dark olive with a play of faint red and copperas-green sometimes on the scales; the fins have a faint orange tint at their extremities.

Habitat.—Beema river at Downde, it attains 6 inches in length.

5. GENUS—OSTEOCHILUS, Günther, Pl. IX, f. 5. a. b.

Rohita sp. Cuv. and Val.

Abdomen rounded. Mouth of moderate width, directed more or less downwards; lips thickened, continuous, fringed or crenulated, but the lower is reflected from off the mandible, leaving it uncovered in the form of a sharp and hard, transverse, prominence. No tubercle at symphysis. Snout obtusely rounded. Barbels generally four. Pharyngeal teeth generally 5, 4, 2/2, 4, 5. Dorsal fin without osseous ray, with a moderate number of branched ones (10 to about 20), commencing in advance of the ventrals. Anal with few rays. Scales of moderate or small size. Lateral line passing to the centre of the base of the caudal fin. Gill rakers short.

Geographical distribution. Burma and E. I. Archipelego.

SYNOPSIS OF SPECIES.

1. *Osteochilus rostellatus*, D. $\frac{2}{18}$, A. $\frac{3}{5}$, L. l. 55, 4 barbels, colours uniform. Burma.

2. *Osteochilus Neilli*, D. $\frac{2-3}{15-16}$, A. $\frac{2}{5}$, L. l. 34; 4 barbels. A

darkish band near commencement of lateral line, and a dark mark before base of caudal fin. *Burma.*

*3. *Osteochilus cephalus*, D. 3/13, A. 3/6, L. 1. 36; 2 barbels. Colours uniform. *Pegu.*

1. *OSTEOCHILUS ROSTELLATUS.*

Rohita rostellatus, Cuv. and Val., XVI, p. 256.

Rohita lineata, Cuv. and Val., XVI, p. 260.

Rohita chalybeata, Cuv. and Val., XVI, p. 271.

Labeo chalybeatus, *Günther, Catal., VII, p. 60.

B. III. D. 2/18, P. 21, V. 9, A. 3/5, C. 29, L. 1. 55, L. tr. 9/10.

Length of head nearly $1/5$, of caudal $2/9$, height of body $2/7$, of dorsal fin $2/11$ of the total length.

Eyes:—diameter $2/7$ of length of head, $1\frac{1}{4}$ diameters from end of snout, 2 diameters apart.

Snout overhanging the mouth which is transverse and not very wide, lips reflected from off lower jaw leaving its sharp edge exposed; both lips fringed and glandular. No lateral lobe to the snout. A distinct inner fold to the upper lip. Four short barbels.

Fins.—Dorsal arises considerably nearer to the snout, than to the base of the caudal, and much in advance of the ventrals; its upper edge is straight. Caudal deeply forked.

Lateral line:— $6\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours:—silvery, the edges of the scales darkest.

Habitat.—Irrawadi and Salween rivers in Burma. The species attains 2 feet in length.

2. *OSTEOCHILUS NEILLI.* Pl. IX, f. 5. *a. b.*

Day, Proc. Zool. Soc. 1870, p. 99.

B. III. D. $\frac{2-3}{15-16}$, P. 15, V. 9, A. $2/5$, C. 19, L. 1. 34, L. tr. $5\frac{1}{2}/6\frac{1}{2}$.

Length of head nearly $1/5$, of caudal $1/4$, height of body $2/7$, of dorsal fin $1/6$ of the total length.

Eyes:—diameter $2/7$ of length of head, $1\frac{1}{2}$ diameters from end of snout, 2 diameters apart.

Body compressed. Snout rounded and smooth, it scarcely overlaps the mouth which is of moderate width. No lateral lobe.

Lips thin, and but slightly reflected; they are both fringed, with two, three, or more rows of well developed papillæ, internal to their outer fringe. The rostral barbels do not reach the orbit, the maxillary extend to beneath its centre.

Teeth, pharyngeal, plough-shaped, 5, 4, $\frac{3}{3}$, 4, 5.

Fins.—The dorsal commences before the ventral, and much nearer to the snout, than to the base of the caudal, its upper border is somewhat convex; caudal deeply forked.

Scales:— $4\frac{1}{2}$ rows between the lateral line and the base of the ventral fin.

Colours.—Greyish yellow, deepest superiorly, every scale being darkest at its base. A darkish spot near the root of the caudal fin, and another ill defined one near the commencement of the lateral line. Fins, yellowish orange, dorsal darkest at its basal half.

Habitat.—Sittoung and Billing in Burma. The largest specimen, out of seven, measures six inches in length.

3. *OSTEOCHILUS CEPHALUS.

Labeo cephalus, Cuv. and Val., XVI, p. 347, pl. 487.

B. III. D. $\frac{3}{13}$, P. 20, V. 9, A. $\frac{3}{6}$, C. 19, L. 1. 36.

Length of head $\frac{1}{5}$, caudal about $\frac{2}{9}$, height of body $\frac{1}{4}$ of the total length.

Eyes:—two diameters from end of snout.

The dorsal profile is much more convex than the abdominal. Interorbital space convex. The snout scarcely projects beyond the jaws, it is rather swollen and has many pores opening on its surface; the mandible has a transverse free edge, with thick lip, both upper and lower being fringed. One pair of short maxillary barbels.

Fins.—The dorsal (from the figure) commences in advance of the ventrals, its upper border is concave. The anal laid flat reaches the caudal.

Colours.—Greenish with the base of each scale darkest.

Habitat.—Pegu attaining one foot in length.

6. GENUS—*CIRRHINA*, Cuv. and Val., pt. Pl. IX. f. 6 ab.,

Dangila sp. Cuv. and Val.—*Cyrene* sp. Heckel.—*Mrigala* sp. Bleeker.—*Crossochilus*, pt. Günther.

Abdomen rounded. Snout depressed or obtusely rounded, with the soft coverings extremely thin. Mouth broad, transverse. Upper lip fringed or entire. Lower jaw rather sharp without any or with a thin lip, destitute of any horny covering, but having a small tubercle above the mandibular symphysis. Barbels small, four, two, or none. Dorsal fin rather short, moderate or long, without any osseous ray, and commencing in advance of the ventrals. Anal fin short, without a row of tiled scales. Pharyngeal teeth 5, 4, 2/2, 4, 5 or 5, 3, 2/2, 3, 5. Scales of large, small, or moderate size. Lateral line continuous, passing to the centre of the base of the caudal fin. Gill rakers short.

Geographical distribution. Fresh waters throughout India, and Burma, and extending onwards through the East Indian Archipelago.

SYNOPSIS OF SPECIES.

1. *Cirrhina Kuhlîi*, D. 3/25, A. 2/5, L. 1. 39-40. Four barbels. Upper lip fringed. *Tavoy.*
2. *Cirrhina Berdmorei*, D. 3/23, A. 2/5, L. 1. 31. Four barbels. Upper lip fringed. *Tennasserim Provinces.*
3. *Cirrhina Leschenaultii*, D. $\frac{3-4}{14-13}$, A. 3/5, L. 1. 42. Four barbels. Upper lip entire. *Southern India.*
4. *Cirrhina mrigala*, D. 3/12, A. 3/5, L. 1. 43. Two barbels. Upper lip entire. *Bengal and Burma.*
5. **Cirrhina anisura*, D. 3/10, A. 2/5, L. 1. 43. No barbels. Upper lip entire. *Bengal.*
6. *Cirrhina dyoheila*, D. 3/10, A. 2/5, L. 1. 42. No barbels. Upper lip entire. *Assam.*
7. **Cirrhina dero*, D. 13. A. 7. One pair of short maxillary barbels. Lips entire. *Assam.*
8. **Cirrhina sada*, D. 13. A. 7. Four barbels, longer than the eye. Upper lip fringed. *Assam.*
9. *Cirrhina gohama*, D. 3/8, A. 2/5, L. 1. 38-40. One pair of short rostral barbels. Upper lip fringed. Some black spots on body. *Orissa and Bengal.*
10. *Cirrhina latius*, D. 3/8, A. 2/5, L. 1. 39. Four barbels. Upper lip fringed. *Northern Bengal, Nepaul and Assam.*

11. *Cirrhitina diplochilus*, D. $\frac{3}{8}$, A. $\frac{2}{5}$, L. 1. 36—39. Four barbels. Upper lip fringed. *Cashmere*.

12. *Cirrhitina bata*, D. $\frac{2-3}{9}$, A. $\frac{2}{5}$, L. 1. 36—38. One pair of short maxillary barbels. Upper lip fringed. *Bengal and Orissa*.

13. *Cirrhitina mosario*, D. 10, A. 7, L. 1. 37. No barbels. Upper lip fringed. *Assam*.

14. *Cirrhitina reba*, D. $\frac{3}{8-9}$, A. $\frac{3}{5}$, L. 1. 35—38. One pair of short rostral barbels. Upper lip indistinctly fringed or entire. *Throughout India*.

15. *Cirrhitina isurus*, D. $\frac{2}{8}$, A. $\frac{2}{7}$, L. 1. 36. One pair of moderately long rostral barbels. Upper lip very distinctly fringed. *Bengal and Assam*.

1. CIRRHINA KUHLLII.

Dangila Kuhlii, Cuv. and Val., XVI, p. 231; Bleeker, Prod. Cyp. p. 197 and Atl. Ich. Cyp., p. 44, t. 16, f. 1; *Günther, Catal., VII, p. 39.

B. III. D. $\frac{3}{25}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 39—40, L. tr. $\frac{7}{7-9}$.

Length of head $\frac{1}{7}$, of caudal nearly $\frac{1}{5}$, height of body $\frac{1}{5}$, of dorsal fin $\frac{1}{6}$ of the total length.

Eyes:—diameter $\frac{1}{3}$ of length of head; 1 diameter from end of snout.

Mouth transverse, sub-inferior, with snout slightly depressed, rounded. Upper lip fringed, a small tubercle above the symphysis of the lower jaw inside the mouth. Maxillary barbels as long as the orbit, and longer than the rostral pair.

Teeth, pharyngeal, plough-shaped, 5, 4, $\frac{3}{3}$, 4, 5.

Fins.—Dorsal without osseous ray, commencing opposite the ninth scale of the lateral line, and at the beginning of the second third of the total length. Upper lobe of the caudal the longest.

Lateral line:—five rows of scales between it and the base of the ventral fin.

Colours.—Silvery, some of the scales with dark spots at their bases forming rows, or horizontal bands. Fins orange, the edges of the caudal stained.

Habitat.—Tavoy where it does not appear to be uncommon.

Several specimens, personally obtained there, measured up to ten inches in length.

2. CIRRHINA BERDMOREI.

Dangila Berdmorei, Blyth, J. A. S. of Bengal, 1860, p. 162; Day Proc. Zool. Soc. 1869, p. 554.

B. III. D. $\frac{3}{23}$, V. 9, A. $\frac{2}{5}$, L. l. 31, L. tr. $\frac{6}{?}$

Length of head $\frac{1}{5}$, of caudal $\frac{1}{4}$, height of body $\frac{1}{4}$, of dorsal fin $\frac{2}{13}$ of the total length.

Eyes:—diameter $\frac{2}{5}$ of head; $\frac{3}{4}$ of a diameter from end of snout.

Pores on front of snout and of a large size. A distinct tubercle above symphysis. Rostral barbels equal the length of the orbit, the maxillary ones are shorter. Lower lip rather thick, distinct from the upper, which last is not fringed.

Fins.—Dorsal arises in the commencement of the second third of the total length. The pectoral does not quite reach the ventral. Caudal deeply forked.

Scales:—three and a half rows exist between the lateral line and the base of the ventral fin.

Colours:—uniform in spirit.

Habitat.—Tennasserim Provinces of British Burma.

3. CIRRHINA LESCHENAULTII.

?*Cyprinus cirrhosus*, Bloch, XII, p. 52, t. 411.

Dangila Leschenaultii, Cuv. and Val., XVI, p. 235, pl. 471.

Cirrhina Blochii, Cuv. and Val., XVI, p. 290.

Cirrhinus Cuvierii, Jerdon, M. J. L. and S., 1849, p. 303.

Cirrhina Leschenaultii, Günther, VII, p. 36.

Venkendi, Tam., *Aruzu*, Tel.

B. III. D. $\frac{3 \cdot 4}{14-15}$, P. 19, V. 9, A. $\frac{3}{5}$, C. 19, L. l. 42—44, L. tr.

9/9, Vert. 21/17.

Length of head $\frac{1}{6}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{15}$ of the total length.

Eyes:—diameter $\frac{2}{7}$ of length of head; $1\frac{1}{8}$ diameters from end of snout; 2 diameters apart.

Maxillary extends nearly to below anterior margin of the orbit. Some fine pores on the snout. Rostral barbels longer than maxillary ones.

Teeth.—Pharyngeal teeth plough-shaped and with their sides serrated, 5, 4, $\frac{3}{3}$, 4, 5.

Fins.—Dorsal arises in the adult considerably in advance of the ventrals, and midway between the snout and the posterior portion of the base of the anal fin ; upper margin of fin concave. Pectoral falciform. Caudal deeply forked or lunated, the centre rays being about $\frac{2}{7}$ the length of the outer ones.

Scales :—in straight rows, $6\frac{1}{2}$ between lateral line and the base of the ventral fin.

Lateral line : nearly straight.

Colours.—Silvery, every scale having a red centre, except along the abdomen where they are of a dirty yellowish white. Dorsal and caudal stained with grey, also the outer end of the anal and pectoral. A darkish line after death is seen along the centre of rows of scales.

Habitat.—Godavery, Kistna and Cauvery rivers, and generally in Southern India. Grows to $1\frac{1}{2}$ feet in length. Is a very active fish and fair eating, but bony.

4. CIRRHINA MRIGALA, Pl. IX. f. 6. *ab.*

Cyprinus mrigala, Ham. Buch., Gang. Fish., pp. 279, 386, pl. 6. f. 79 ; McClland, Ind. Cyp., pp. 276, 350.

Cirrhina rubripinnis, Cuv. and Val., XVI, p. 288, pl. 479.

? *Cirrhina plumbea*, Cuv. and Val., XVI, p. 289.

Cirrhina mrigala, Cuv. and Val., XVI, p. 294 ; Günther, Catal., VII, p. 35.

Mrigala Buchanani, *Bleeker, Prod. Cyp., p. 226.

Mirgah, Ooriah ; *Mrigah*, Beng. ; *Nga-kyin* and *Nga-gyein*, Burm.

B. III. D. 3/12, P. 15, V. 9, A. 3/5, C. 19, L. 1. 40—43, L. tr. $6\frac{1}{2}/8\frac{1}{2}$.

Length of head $2/7$, of caudal $1/5$, height of body $1/4$ of the total length.

Eyes :—diameter $2/7$ of length of head.

Small pores sometimes present on the snout.

The posterior extremity of the maxilla extends to nearly beneath the anterior margin of the orbit. Snout not tuberculated. Rostral barbels only present, well developed and nearly as long as the eye. Opercle two-thirds as wide as high, greatest width of exposed portion of interopercle equals half the diameter of the eye.

Teeth.—Pharyngeal teeth plough-shaped, 5, 4, $2/2$, 4, 5.

Fins.—Dorsal arises rather nearer to the snout than to the base of the caudal fin, and opposite the 12th scale of the lateral line, upper margin of fin very slightly concave. Caudal with sharp and deeply forked lobes, which have convex edges internally.

Scales :—in straight rows, seven in the line between the origin of the dorsal fin and the lateral line, and $5\frac{1}{2}$ between the latter and the base of the ventral.

Lateral line :—in single tubes, and almost straight in its direction.

Colours.—Silvery, dark grey along the back, sometimes having a coppery tinge, and the pectoral, ventral and anal orange. Eyes golden.

Habitat.—Rivers and tanks in Bengal and Burma, grows to 3 feet in length. It is an excellent species for stocking tanks with. I have taken it in Rangoon 18lb in weight.

This species is closely allied to *C. chinensis*, Günther, the head, however, is shorter and the mouth not quite so wide. The two species might almost be classed as local varieties.

5. CIRRHINA ANISURA.

Gobio anisurus, McClelland, Ind. Cypr., pp. 278, 360, pl. 40, f. 2 ; *Cuv. and Val., XVI, p. 463.

Cirrhina anisura, Steind., Sitz. Ak. Wiss., Wien, 1867, LVI, *Günther, Catal., VII, p. 37.

B. III. D. $\frac{3}{9-10}$, P. 17, V. 9, A. $2/5$, C. 19, L. l. 38, L. tr. $7\frac{1}{2}/10\frac{1}{2}$.

Length of head $2/9$ and height of body $2/7$ of the total length.

Eyes.—Diameter $2/7$ of length of head, 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart. Upper lip entire, lower lip fringed. No barbels.

Fins.—Dorsal commences midway between the snout, and base of caudal, lower lobe of caudal longer than the upper. Ventral under centre of dorsal.

Scales.—Five and a half rows between lateral line and base of ventral fin.

Colours.—Silvery.

Habitat.—Bengal and Assam.

6. CIRRHINA DYOCHEILA.

Labeo (Cyprinus) dyocheilus, McClell., Ind. Cyp., pp. 268, 330, pl. 37, f. 1 ; Cuv. and Val., XVI, p. 461.

Cirrhina dyocheilus, Günther, Catal., VII, p. 37.

Goreah, Assam.

B. III. D. 3/10, P. 18, V. 9, A. 8, C. 19, L. 1. 42, L. tr. 8/8.

Barbels rudimentary or absent.

Snout with pores, lower lip distinct.

Fins.—Dorsal commences nearer to the end of the snout than to the root of the caudal, and opposite the tenth scale of the lateral line.

Scales.—Five rows between the lateral line and the base of the ventral fin.

Colours.—Bluish or brownish black above, becoming silvery white on the abdomen.

Habitat.—“It is found in the clear active currents of the Brahmaputra, from middle Assam to the rapids at the extremity of the valleys, but appears to be equally unknown in mountain torrents, and sluggish rivers and jheels in the plains.” (*McClelland*). It grows to two feet and upwards in length.

7. **CIRRHINA DERO*.

Cyprinus dero, Ham. Buch., Fish. Ganges, pp. 277, 331, 385, pl. 22, f. 78; **McClelland*, Ind. Cyp., pp. 267, 326.

Cirrhina dero, **Cuv. and Val.*, XVI, p. 296.

Dhengro, Assam.

B. III. D. 3/10, P. 18, V. 9, A. 7, C. 19.

“Head oval and blunt. The snout projects a little beyond the mouth, is fleshy, and marked with callous points. * * The mouth is small, the upper jaw protruding in opening. The lips are fleshy and smooth on the edges. * * A ridge on the lower jaw. * * At each corner of the mouth is a minute tendril.”

Eyes.—“High up and small.”

“The back slopes gently before the fin, and is rather sharpened. The edge of the belly is rounded.”

Fins.—“The pectoral fins are shorter than the head. * * The lobes of the tail are sharp and equal.”

Lateral line :—“is below the middle and is bent downwards.”

Scales :—“of moderate size.”

Colours :—“of the back and belly are irregularly indented into each other on the sides. The dorsal and caudal fins are dotted.”

Habitat.—Brahmaputra river, attaining four inches in length.

This species may be a *Labeo* (*Tylognathus*) under which genus Dr. Günther has placed it amongst the doubtful species, observing, "two (?) barbels, well developed, at the angle of the mouth," their length evidently having reference to the figure and not to the text.

8. *CIRRHINA SADA.

Cyprinus sada, Ham. Buch., Fish. Ganges, pp. 344, 393; *Cuv. and Val., XVI, p. 385.

Gonorrhynchus fimbriatus, *McClell., Ind. Cyp., pp. 282, 375, pl. 43, f. 3.

Crossochilus sada, *Günther, Catal., VII, p. 74.

B. III, D. 13, V. 9, A. 7.

Barbels four, longer than the eye, but shorter than the head. Upper lip said to be fringed. From the figure the snout appears to overhang the mouth.

Colours.—Green above, silvery below.

Habitat.—Assam.

9. CIRRHINA GOHAMA.

Cyprinus gohama, Ham. Buch., Fish. Ganges, pp. 346, 393; *Cuv. and Val., XVI, p. 413.

Gonorrhynchus brevis, *McClell., Ind. Cyp., p. 373, pl. 43, f. 6 (from H. B. MS.)

Crossocheilus gohama, Bleeker, Prod., Cyp. p. 110 (no description); Günther, Catal., VII, p. 72; Day, Proc. Zool. Soc. 1869, p. 371.

Kala-batta, Bengali.

B. III, D. 3/8, P. 15, V. 9, A. 2/5, C. 19, L. 1. 38—40, L. tr. 6/6.

Length of head 2/11, height of body 2/11, of dorsal fin 1/5 of the total length.

Eyes.—Diameter 1/3 of length of head; 1 diameter from end of snout and apart.

Dorsal profile more convex than the abdominal. Upper surface of the head broad; snout overhanging the jaws and having a small lateral lobe. Both lips fringed. A pair of rostral barbels half as long as the diameter of the orbit.

Fins.—Dorsal commences midway between the snout and the posterior extremity of the base of the anal fin, caudal deeply forked.

Lateral line:— $3\frac{1}{2}$ to 4 rows of scales between it and the base of the ventral fin.

Colours.—Brownish olive, irregularly spotted with black marks. Dorsal and caudal fins yellowish, stained with grey, the others orange.

Habitat.—Orissa and Bengal. It attains 6 inches in length.

10. CIRRHINA LATIUS.

Cyprinus latius, Ham. Buch., Fish. Ganges, pp. 345, 393; *Cuv. and Val., XVI, p. 411.

Gonorhynchus macrosomus, McClell., Ind. Cyp., pp. 282, 372, pl. 43, f. 7, (from H. B.'s MSS.)

Crossocheilus latius, *Bleeker, Pro. Cyp., p. 110 (no description); Günther, Catal., VII, p. 71.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 39, L. tr. $5\frac{1}{2}/6\frac{1}{2}$.

Length of head $\frac{2}{11}$, of caudal $\frac{2}{9}$, height of body $\frac{2}{11}$ of the total length.

Eyes.—Diameter $\frac{1}{4}$ of length of head; $1\frac{1}{3}$ diameters from end of snout.

Lips thin, the upper one fringed. The rostral pair of barbels rather shorter than the eye, the maxillary pair minute.

Fins.—Upper lobe of the caudal the longest.

Lateral line:— $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colouration:—uniform.

Habitat.—Northern Bengal, Nepaul, and Assam. It appears to be a small species.

11. CIRRHINA DIPLOCHILUS.

Barbus diplochilus, Heckel, Fische aus Cashmir, p. 53, t. 10, f. 1; Cuv. and Val., XVI, p. 204.

Tylognathus barbatulus, Heckel, in Hügels Reise, IV, p. 376, and in Russ. Reisen, II, iii, p. 283, (no description).

Crossocheilus diplochilus, Steind., Verh. Zool.-bot. Gesellsch. Wien, 1866, p. 791.

Crossochilus barbatulus, Günther, Catal., VII, p. 72.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 36—39, L. tr. $4\frac{1}{2}/6$.

Length of head $\frac{1}{4}$, of body $\frac{2}{9}$ of total length without the caudal fin.

Snout thick much projecting beyond the jaws. Rostral barbels short, maxillary ones minute.

Eyes.—Of moderate size, situated somewhat before the middle of the length of the head.

Fins.—Dorsal commences in advance of the ventrals, and nearer the end of the snout than the root of the caudal, which latter fin is deeply forked.

Lateral line :— $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours :—uniform.

Habitat.—Cashmere. It does not appear to grow to a large size.

12. CIRRHINA BATA.

Cyprinus bata, Ham. Buch., Fish. Gang., pp. 283, 386 ; *Cuv. and Val., XVI, p. 427.

Cyprinus acra and *cura*, Ham. Buch., l. c. pp. 284, 386 ; *Cuv. and Val. XVI, p. 428.

Gobio lissorhynchus, McClell., Ind. Cyp., pp. 277, 355, pl. 55, f. 5.

Crossochilus rostratus, Günther, Catal., VII, p. 72.

Crossocheilus bata, Day, Proc. Zool. Soc., 1869, p. 371.

Dunguda-porah, Ooriah ; *Dommarci-batta*, Beng.

B. III. D. $\frac{2-3}{9}$, P. 19, V. 9, A. $\frac{2}{5}$, C. 19, L. l. 36—38,
L. tr. $\frac{5\frac{1}{2}-6\frac{1}{2}}{6-7}$.

Length of head $\frac{2}{9}$, of caudal $\frac{2}{9}$, height of body $\frac{1}{4}$, of dorsal fin $\frac{2}{9}$ of the total length.

Eyes.—Diameter $\frac{1}{4}$ of length of head ; 1 diameter from end of snout ; nearly 2 diameters apart.

Snout considerably in advance of the jaws in the young, but slightly so in the adult, when it is usually covered with pores. Both lips fringed in the young, generally only the lower one in the old. A pair of maxillary barbels.

Teeth, pharyngeal.—The two outer teeth of the upper row plough-shaped, the rest molarform, 5, 3, $\frac{2}{2}$, 3, 5.

Fins.—Dorsal commences midway between the snout and the posterior extremity of the base of the anal fin. Caudal deeply forked.

Lateral line :— $6\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours :—vary with the age of the fish ; generally silvery, darkest along the back, and with the lower fins stained orange, fine black dots on all the fins. When about 4 inches long, there are 3 or 4 small black spots on the 5th and 6th scales of the lateral line, which gradually and almost entirely fade as age advances.

Habitat.—Rivers of Bengal as far south as the Mahanuddi. As this fish, which attains nearly 2 feet in length, is extensively used for stocking tanks, it is not improbable, as suggested by McClelland, that the three varieties mentioned by Hamilton Buchanan refer to one species. In one specimen, 10 inches long, the snout was covered by pores, another captured of the same size, and the same day, in the same tank had no pores.

13. *CIRRHINA MOSARIO.

Cyprinus mosario, Ham. Buch., Fish. Ganges, pp. 346, 393 ; *Cuv. and Val., XVI, p. 448.

Gonorhynchus gobioides, McClell., Ind. Cyp., pp. 280, 369, pl. 43, f. 1 ; *Cuv. and Val., XVI, p. 465.

Crossocheilus gobioides, *Bleeker, Pro. Cyp., p. 110, (no desc.)

Herilwa, Assam.

B. III. D. 10, P. 15, V. 9, A. 7, C. 19, L. 1. 37, L. tr. 9 to base of ventral.

Length of head is equal to the height of the body, and one-fourth of its length. Dorsal and abdominal profiles equally convex. Snout overhanging the mouth. Mouth small, transverse. Upper lip fringed. No barbels. Alimentary canal 8 times the length of the body.

Colours :—uniform.

Habitat.—Assam, attains about 6 inches in length.

A somewhat similar fish is described as the *Chondrostoma fulungee*, Sykes, *Gymnostomus fulungee*, *Günther.

14. CIRRHINA REBA.

Cyprinus reba, Ham. Buch., Fish. Ganges, pp. 280, 386 ; McClelland, Ind. Cyp., pp. 276, 354.

Gobio limnophilus, McClell., Ind. Cyp., pp. 279, 385, pl. 55, f. 3 ; *Cuv. and Val., XVI, p. 464.

?*Gobio bicolor*, McClell., l. c. pp. 360, 278.

Chondrostoma boggut, Sykes, Trans. Zool. Soc., 1841, p. 359 ;

*Jerdon, M. J. L. and Sc., 1849, p. 309.

Chondrostoma gangeticum, *Cuv. and Val., XVII, p. 399 ; *Günther, Catal., VII, p. 76.

Cirrhina Dussumieri et reba, Cuv. and Val., XVI, pp. 291, 292, pl. 480.

Cirrhina Bengaliensis, Bleeker, Verh. Bat. Gen., XXV, Beng. and Hind. p. 136.

Mrigala Bengaliensis, Bleeker, Pro. Cyp., p. 226, (no description).

Cirrhinichthys Dussumieri, Bleeker, Atl. Ich. Cyp., p. 28.

Gobio bangon, limnophilus et Dussumieri, Jerdon, M. J. L. and S., 1849, p. 308.

Cirrhina rewah, Steind., Sitz. Ak. Wiss. Wien, LVI.

Crossocheilus reba, Günther, Catal., VII, p. 74.

Eelemose and *Chittahri*, Tel. ; *Chetchua-porah* Ooriah ; *Batta*, Bengali.

B. III. D. 3/8-9, P. 15, V. 9, A. 3/5, C. 19, L. l. 35—38, L. tr. 7/7.

Length of head 1/6, of caudal nearly 1/4, height of body nearly 1/4, of dorsal fin 2/11 of the total length.

Eyes :—diameter nearly 1/4 of length of head, 1½ diameters from end of snout, nearly 2 diameters apart.

Mouth anterior ; upper lip of the young indistinctly fringed, of the adult generally entire. One pair of short rostral barbels. Some fine pores over the snout.

Teeth, pharyngeal, 5, 4, 1/1, 4, 5.

Fins.—Dorsal commences slightly anterior to the ventral, upper margin of the fin concave. Caudal with deep, sharp lobes.

Lateral line :—4 to 5 rows of scales between it and the base of the ventral fin.

Colours.—Silvery, scales generally darkest at their edges.

Habitat.—Throughout India, attaining a foot in length.

15. CIRRHINA ISURUS.

Gobio isurus, McClelland, Ind. Cyp., pp. 277, 357 ; *Cuv. and Val., XVI, p. 431.

B. III. D. 2/8, P. 17, V. 9, A. 2/5, C. 19, L. l. 36, L. tr. 4½, 5½.

Length of head 1/6, height of body 1/5, of dorsal fin 1/5 of the total length.

Eyes :—diameter 2/7 of length of head ; nearly 2 diameters from end of snout and the same distance apart.

Snout thick, projecting, no pores or lateral lobe; mouth transverse, inferior. Upper lip deeply fimbriated. Lips reflected from off both jaws which have sharp edges, but no horny covering. Rostral barbels two-thirds as long as orbit.

Fins.—Dorsal commences midway between the snout and the posterior margin of the base of the anal. Caudal deeply forked, upper lobe the longest.

Lateral line:— $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours.—Silvery, apparently a dark stripe along the middle of the side.

Habitat.—Hooghly.

[To be continued in the next number.]



NOTES ON TERRESTRIAL MOLLUSCA FROM THE NEIGHBOURHOOD OF MOULMEIN (TENASSERIM PROVINCES), WITH DESCRIPTIONS OF NEW SPECIES,—by DR. F. STOLICZKA, *Palæontologist, Geol. Surv. of India; Hon. Secy. Asiat. Soc. Bengal.*

(With 8 plates.)

[Received and read 5th January, 1871.]

The following observations are offered on a small collection of Mollusca made, during the month of August 1869, in the neighbourhood of Moulmein, Tenasserim Provinces. It is not my intention to give a complete list of all the shells which have been described from that neighbourhood,—though such may at some future time prove to be a very desirable acquisition,—but merely to restrict my remarks to those species which I have myself collected, particularly with reference to some points in the anatomy of the animals.

The land shells of this part of the Malayan country received early attention through the collecting zeal of the Rev. Dr. Mason, Capts. Sankey and Gordon, Mr. Theobald and many others. The materials have been chiefly worked out by Dr. A. Gould, Mr. Benson, and Mr. Theobald.

The fauna in general is intimately connected with that of the lower Tenasserim Provinces, Siam and Camboja, and is in the main characteristically Malayan. As regards variety and number of terrestrial Mollusca, these provinces are well known to range among the richest of the Malayan regions. The interest of this fauna is besides considerably increased by the many peculiar forms it possesses of its own, and which do not appear to occur in other parts of the great Malayan Zoological province. I only need to allude to genera like *Pollicaria* (= *Hybocystis*), *Raphaulus*, *Clostophis*, *Sophina*, *Sesara*, &c. The explanation of this peculiarity must probably be sought in the physical condition of the country. Indeed, it would seem that scarcely anywhere could more favourable conditions for the development of small local faunas be found, than exist in the neighbourhood of Moulmein.

Almost all round this place the country consists of isolated hills, or short ranges of hills, composed of sandstones or shales, or more commonly of limestone rock. Many of these hills rise up to elevations of from 2000 to 3000 feet above the level of the sea, and are separated by low land which, for a large portion of the year, is under water. The rocks in question, forming the hills, mostly appear to belong to palæozoic (chiefly carboniferous) formations, and it seems probable that for a long period the country was not affected by any very considerable change in the level. On the other hand, it can scarcely be doubted, that at no very distant geological period those hills represented as many isolated islands in an extensive bay, a physical condition similar to that of the present Mergui Archipelago. The shallow waters between the hills were only gradually reclaimed to dry land by alluvia derived from the more elevated surrounding country. Whatever progress these conditions may have attained, it appears tolerably certain, that the isolation of the hills must have existed during a considerable length of time, and there is also no apparent reason for believing, that the fauna, existing on these hills, had been much affected by any particularly destructive agencies; moreover the insular conditions must have been rather favourable to animal and vegetable life.

All these circumstances tend to shew that the fauna of these hills has existed for a long period, and that at the same time the pro-

tracted isolation admitted of the development of certain persistent peculiarities of the animals in different localities. With regard to the first point, it is a noteworthy fact that most of the cretaceous species of *Helicidæ*, and a large number of the older tertiary ones, belong to the *Angystoma* group which is so largely represented in this part of the Malayan province. With regard to the second point, it must be remembered that the nature of the ground is a most important agent in the development and prosperity of the molluscous (and any other) fauna (or flora); it regulates to a very large extent the geographical distribution of the species. It is well known that limestone ground is more suitable to the existence of land-shells, than any other kind of rock. In the neighbourhood of Moulmein this is strikingly apparent; for while some of the limestone localities literally swarm with shells, there are barely any to be found on the neighbouring sandstone or metamorphic hills, which in other respects possess a perfectly similar climate, &c.

The distinction by no means only applies to the number of specimens, but it affects equally markedly the habitat of certain species, and even genera. Thus, for instance, there is scarcely a single specimen of a *Plectopylis achatina* to be met with on a sandstone hill, while at every limestone rock the species may be collected in thousands. The same applies to *Plectopylis cyclaspis*, though this species is not so common as the former. All the known species of *Sophina*, nearly all the *Sesara*, several peculiar *Streptaxis*, *Raphaulus*, *Pollicaria* and others only occur on limestone ground, while *Rotula anceps*, *Helix* [*Fruticicola*] *similaris*, and chiefly also the species of *Helicarion*, occur on sandstone hills and low land. Again some species, like *Macrochlamys honesta*, *Conulema infula* (var. *attygia*), *Mycrocystis molecula* are to be met with almost everywhere, but specimens occurring on limestone localities always possess a more solid and thicker shell, than those on sandstone, or on alluvial ground. The knowledge of the nature of the ground is, therefore, a very important consideration in discriminating species and mere varieties of one and the same species from each other. In the course of my descriptions I shall notice several instances which bear upon this point.

That the protracted isolation of the different limestone hills had

an influence upon the development of locally, and now persistently, distinct forms, which evidently descended from a common stock, will best become evident from a few instances, which are worthy of record.

At Moulmein about the great Pagoda occurs a species of *Cyclophorus* which Mr. Theobald called *C. Haughtoni*. The specimens are generally lighter or darker brown, and, except on the keel, unspotted. At the 'Farm-caves' the same species occurs, but always marked with numerous white spots, and at Damotha a third form is met with, being generally somewhat smaller and higher, and provided with small pale spots or reticulated streaks; this form has been named by Mr. Theobald *C. affinis*. Again, at the 'Farm-caves' occur in great abundance *Sophina calias* and *discoidalis*, *Sesara pylaica*, *Clausilia Philippiana*, *Streptaxis Sankeyanus*, *Pollicaria grvida*, *Raphaulus chrysalis*, &c., none of which are found on a perfectly similar limestone hill at Damotha, barely 15 miles distant from the former. There we find *Sophina forabilis*, *Sessara infrendens*, *Georissa liratula*, *Diplommantina carneola*, *Rhiostoma Haughtoni*, and other peculiar forms, &c. South of Moulmein, again on similar limestone hills, occurs *Sophina conjungens*, while *calias* and *discoidalis* are rare, *Streptaxis obtusus*, &c., but not a single *Pollicaria* or *Raphaulus* or *Rhiostoma*. Again at another limestone hill on the Attaran river there is only a peculiar banded variety of *Sophina discoidalis* to be found, *Strept. Sankeyanus* is replaced by the allied *Strept. Hanleyanus*, *Sesara pylaica* by *Sesara Attaranensis*, Theob. &c. I could multiply the examples, but those quoted will indicate that the molluscan fauna of each limestone hill, or range of hills, possesses certain forms representative of, or allied to, others which occur on a neighbouring hill, while at the same time it has a certain number of local, peculiar, species. This is a condition which we are generally accustomed to find on small separate islands within an Archipelago.

In conclusion I may observe that the present communication contains species of both of the large divisions of pulmoniferous Mollusca, the CYCLOSTOMACEA and the HELICACEA. It will be noticed that the work is somewhat unequally executed, but it is done so with a certain object.

In the CYCLOSTOMACEA I have described several new species, and of others, which were met with, I have only noted the external characters of the animals or shells. I have avoided going into anatomical details here, because I hope to place them on record in a contemplated Monograph of the Indian and Burmese CYCLOSTOMACEA, to be published with the co-operation of Mr. W. T. Blanford.

Among the HELICACEA, or PULMONATA, as usually restricted, the anatomical details form the greater part of the work. The correctness of Gray's and Dorn's suggestions to unite *Streptaxis*, *Ennea* and *Streptostele* into a separate group has, I think, been satisfactorily proved, and the relation of these forms to *Testacella* will be pointed out further on. Of the *Clausiliidæ* I have given some notes regarding *Cl. Philippiana*, as the anatomy of no Indian *Clausilia* has yet been published. In the *Pupidæ* two interesting new species will be found described a *Pupa* and a *Hypselostoma*. In the *Helicidæ*, the propriety of the generic designations of *Plectopylis* and *Trachia* was found to be supported by the examination of the anatomy of the animals. Among the *Zonitidæ*, at last, I have in a similar way recorded the propriety of the generic names *Sesara* and *Sophina*, and there also will notes be found on the anatomy of *Macrochlamys*, *Rotula*, *Myrocystis* and a newly proposed genus *Conulema*.

Group. CYCLOSTOMACEA.

Fam. CYCLOPHORIDÆ.

The species of *Cyclophorus* (as restricted), known to occur in the neighbourhood of Moulmein: are (1) *C. Haughtoni*, Theobald, (from Moulmein itself), a species closely allied to Sowerby's *aquila*; (2) *C. affinis*, Theobald, (from Damotha), somewhat allied to Pfeiffer's *excellens*; and a third form is found at the Farm-caves, it has the angular periphery of *Haughtoni*, but a spotted shell like *affinis* or *Siamensis*. All the forms may be considered as varieties of one and the same species, but in order to ascertain whether Theobald's name *Haughtoni* is applicable to them, a close comparison of typical forms of several of the allied species from Siam and adjoining countries must be made. I will not enter now upon this question, as the three varieties noticed have lately been figured in the 'Conchologia Indica,' though by no means characteristically.

(4). *C. speciosus* (or perhaps rather *aurantiacus*) occurs at Zwagabin.

CYCLOPHORUS [MYXOSTOMA] CALYX, Bens.

Ann. and Mag. N. H., 2nd ser., XVII, p. 228,—Hanley and Theobald, Conch. Indica, pl. IV, fig. 4.

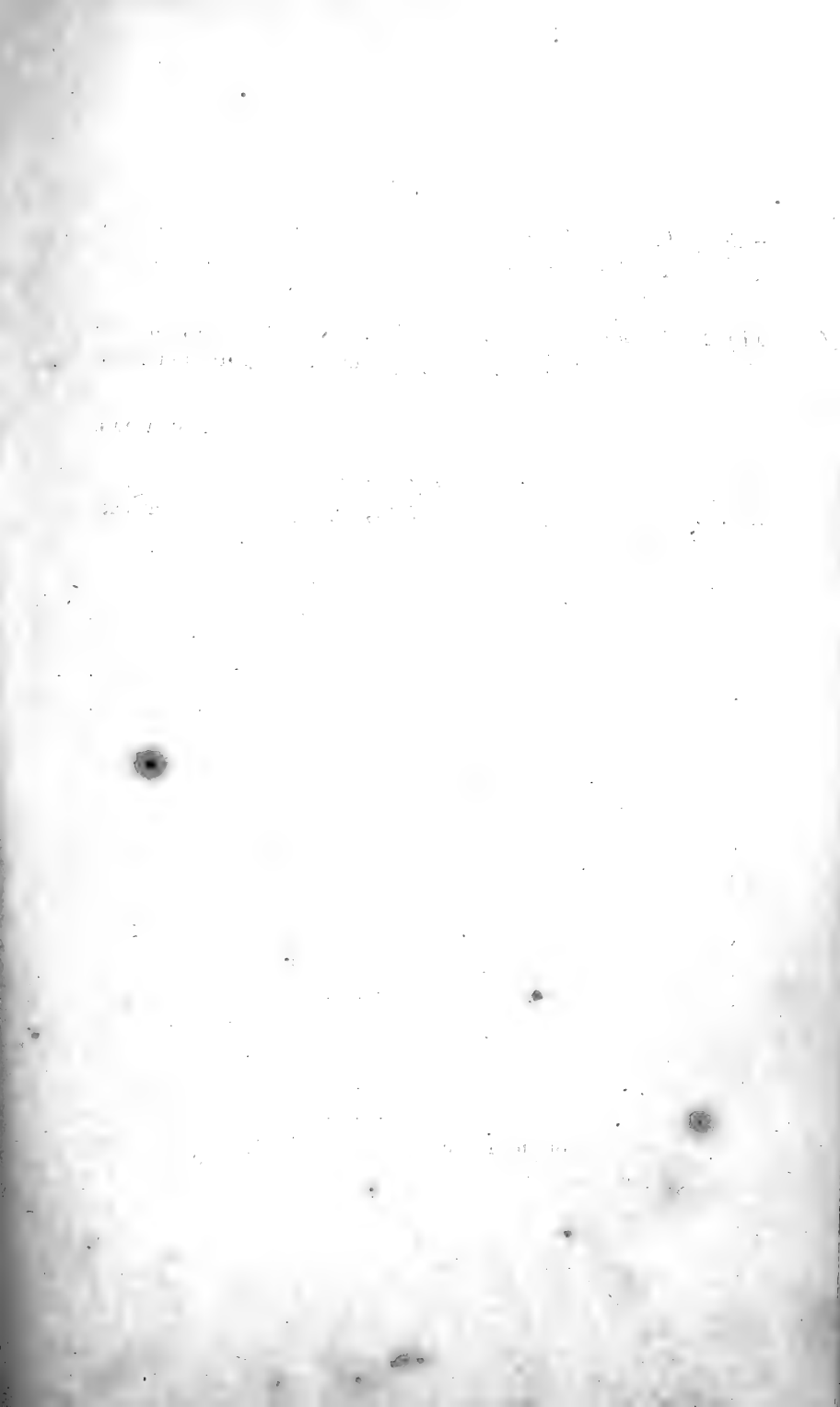
This species is found on all the limestone hills about Moulmein. The figure in the Conch. Indica is far from characteristic and entirely insufficient for the identification of the species. It is strange to find there again the mistake of the originally recorded locality "Akoutang" repeated, though Mr. W. T. Blonford had corrected it already twice.

The animal is identical in form with those of other CYCLOPHORIDÆ, only of smaller size; when full grown the body is black, with very long subulate tentacles, slightly thickened near the tips, the rostrum is long and deeply cleft in front, the foot rather elongated, posteriorly narrowly produced and pointed; eyes rather small, placed laterally at the base of the tentacles on barely perceptible bulgings. The sides of the foot and the tentacles are usually paler than the body, and young specimens are pale grey coloured throughout. The largest specimen found south of Moulmein measures: Diam. maj. 14; d. min. 12; alt. testæ 7·2, alt. ult. anf. cum perist. 5, diam. apert. int. 4 mm.

Cyclophorus [Myxostoma] Inglisianus, Stol., pl. vi, fig. 1.

Cycl. testa subdiscoidea, late umbilicata; anfractibus $4\frac{1}{2}$, primo depresso, albido, lævigato, ceteris teretibus, paululum in amplitudine accrescentibus, sordide lutescente albescentibus, strigis fuscis, supra retrorse angulatis, ad peripheriam rotundatam ult. anf. fascia castanea intersectis, notatis, epidermide pallida transversim rugulatim striata indutis; suturis profundis, simplicibus; apertura paulum descendente et obliqua, circulari, marginibus junctis, paululum incrassatis, haud dilatatis, supra prope suturam leviter insinuatis. Operculo corneo, tenui, circulari, anfractibus 7 extus paulo lamelliforme exstantibus composito, medio depressiusculo, intus polito, medio submammillato. Diam. maj. 9, d. min. 7·5, alt. totius testæ 5, alt. ult. anf. prope aperturam 3, diam. apert. 2·7 mm.

Animal plumbeo-cinereum, tentaculis longis, acutis, nigricantibus, pede pallidescente, angusto, postice acuto; rostro longo, nigricante, antice ad marginem modice lobato.



Pl. VI.

- Fig. 1. *Cyclophorus* [*Myxostoma*] *Inglisianus*, n. sp., p. 148.—1, natural size, 1a, 1b, 1c front, top and lower views, twice the natural size.
- Fig. 2. *Pterocyclus ater*, n. sp., p. 149.—2, 2a, 2b, front, top, and umbilical views, and 2c, operculum; all figures in natural size.
- Fig. 3. *Diplommatina carneola*, n. sp., p. 152.—front and side views.
- Fig. 4. *Dipl.* [*Palaina*] *crispata*, n. sp., p. 153,—ditto.
- Fig. 5. *Georissa liratula*, n. sp., p. 157, 5c, represents the internal side of the operculum.
- Fig. 6. *Georissa Blanfordiana*, n. sp., p. 158.
- Fig. 7-10. *Clausilia Philippiana*, Pfr., p. 174.—7, a series of teeth of the radula, the numbers indicate the distance of the teeth from the centre line; 8, the body with the different organs exposed; 9, the generative organs; 10, the jaw.

ft.—foot.

t.—eye-pedicle.

oe.—mouth.

mr.—retractile muscle of the body.

a.—anus.

ab.—part of mantle-edge.

sg.—salivary glands.

mo.—muscle of the oral parts.

mt.—right mantle side.

li.—liver.

ut.—uterus.

cd.—appendage of the receptaculum seminis.

i.—intestines.

st.—stomach.

alg.—albuminous gland.

h.—heart.

k.—kidney.

l.—lungs.

p.—penis.

vd.—vas deferens.

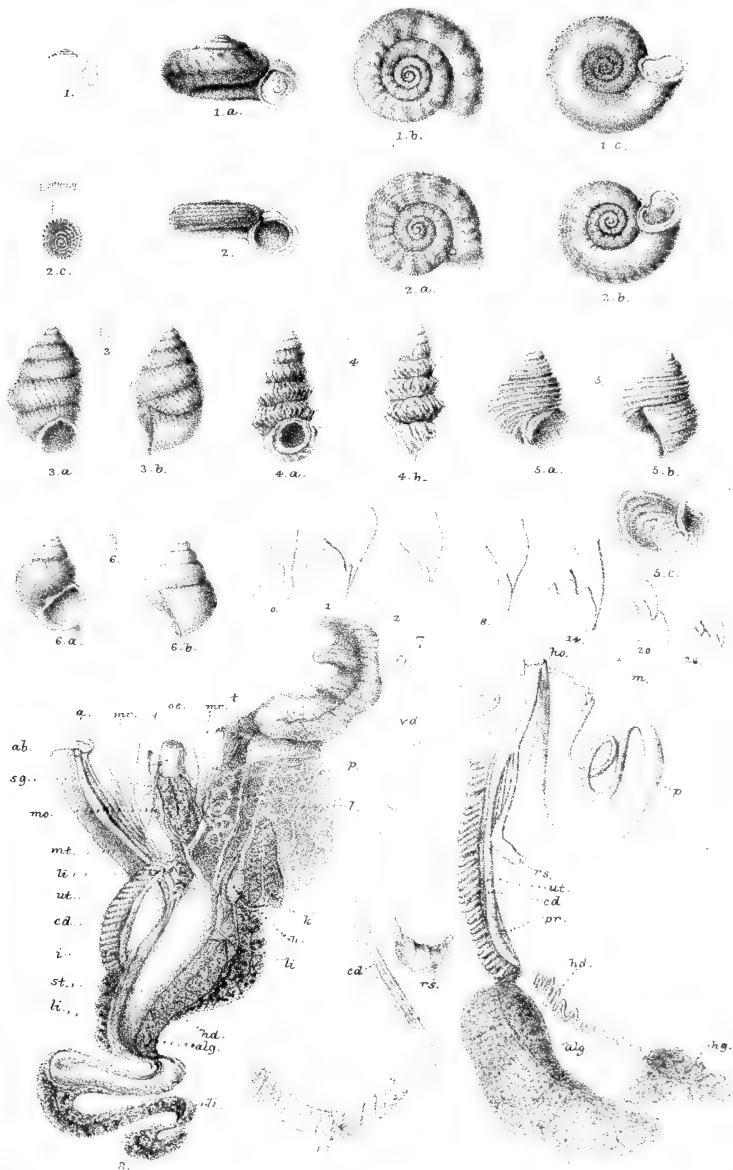
m.—retractile muscle.

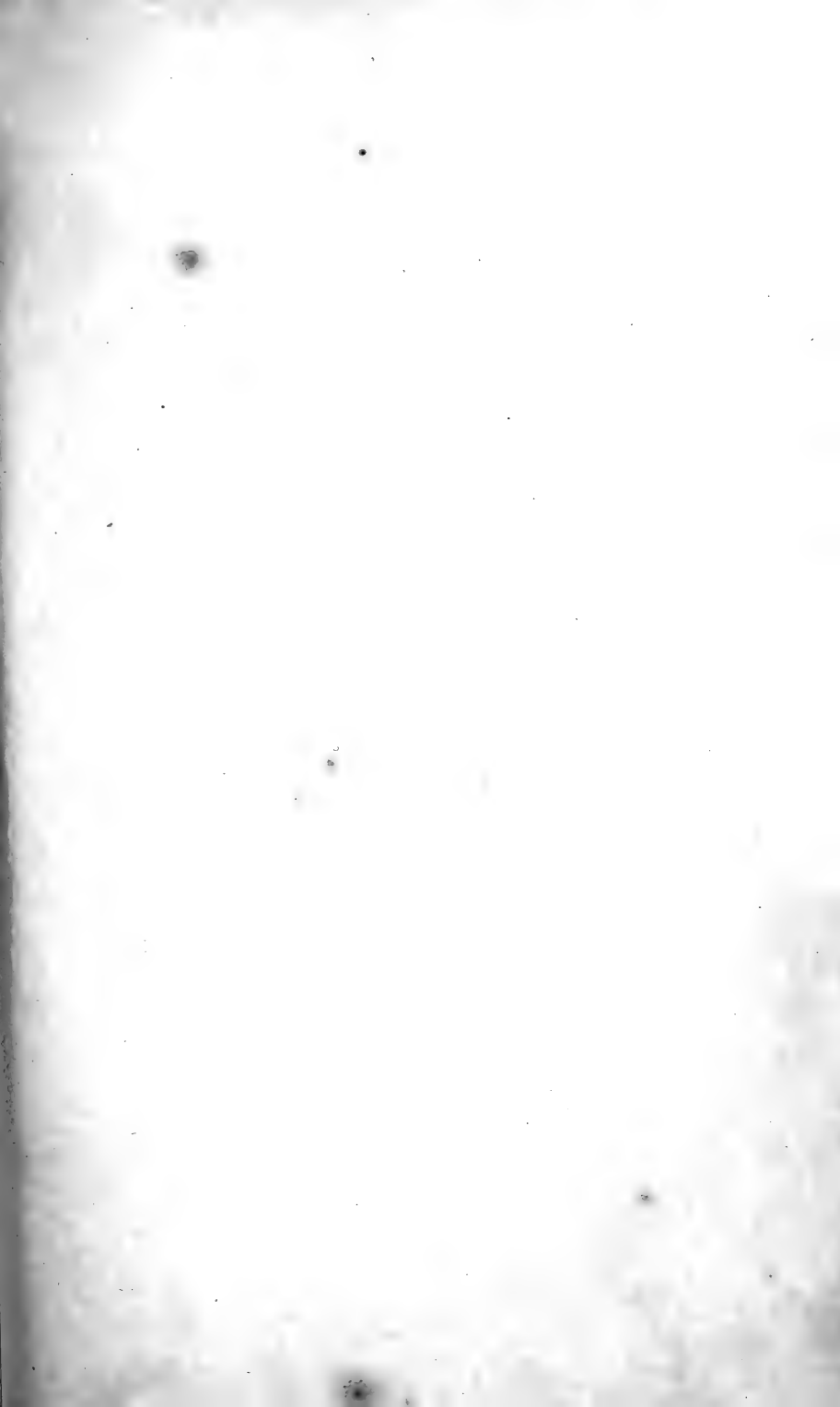
pr.—prostata.

hd.—hermaphrodite duct.

hg.—hermaphrodite gland.

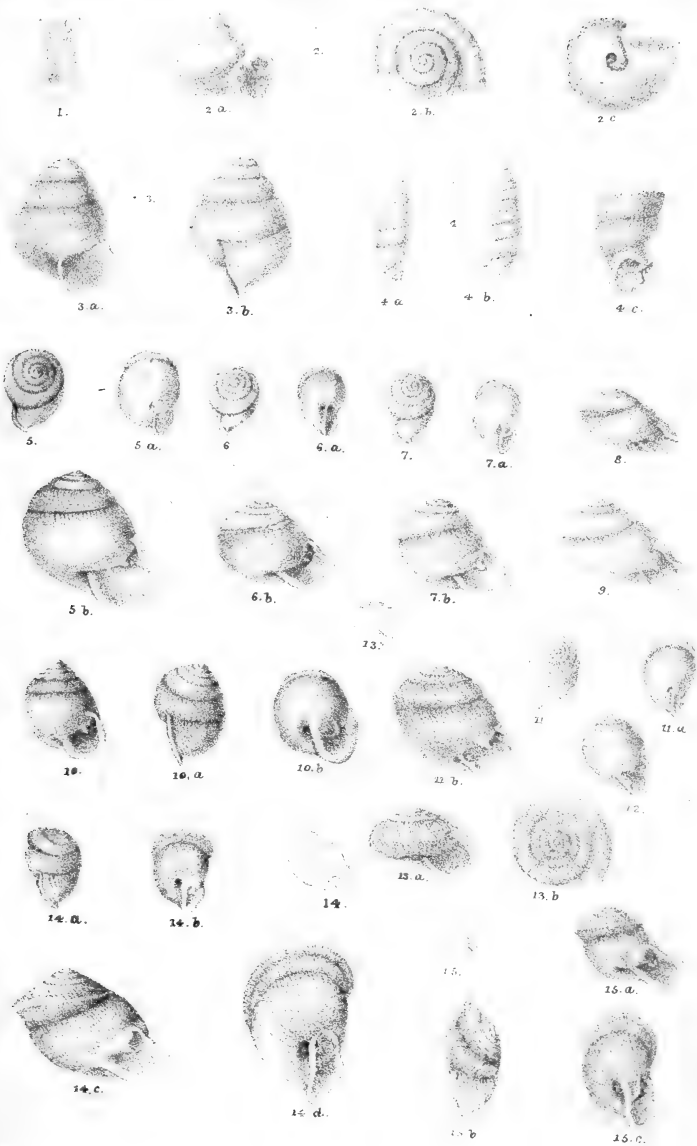
ho.—herm. opening.

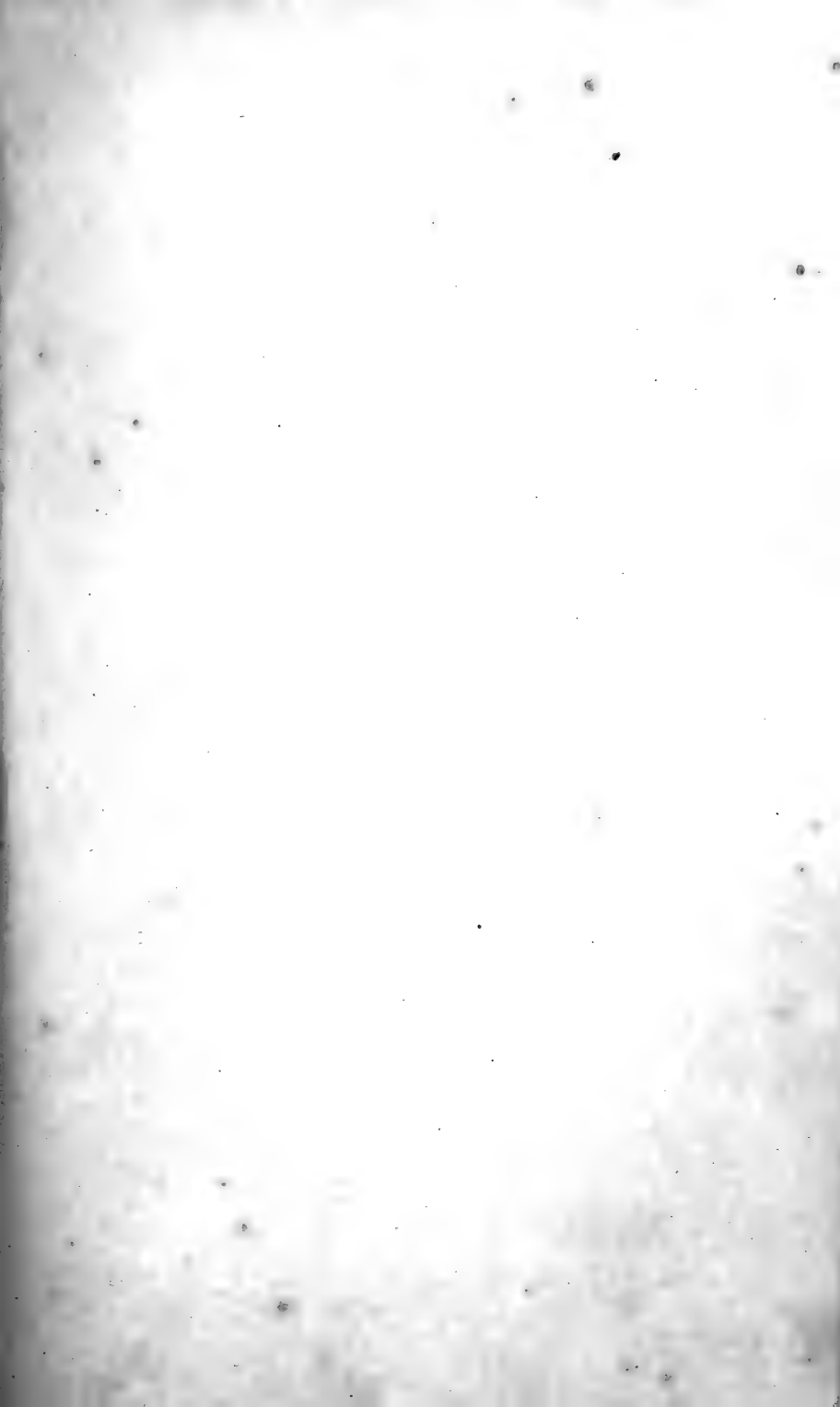




Pl. VII.

- Fig. 1. *Hypselostoma tubiferum*, Bens., p. 173.—View of the animal seen from above.
- Fig. 2. *Hypselostoma Dayanum*, n. sp., p. 172.—front, top and lower views, enlarged.
- Fig. 3. *Pupa lignicola*, n. sp., p. 171.
- Fig. 4. *Ennea* [*Huttonella*] *cylindroidea*, n. sp., p. 171.
- Fig. 5, 6, 7. *Streptaxis Burmanicus*, Blf., p. 163. The front figures 5*b*, 6*b*, 7*b* are enlarged, the side and lower views of the shells are of natural size; 5 is a specimen from Tonghoo, very similar to the type which is from Arracan; 6 and 7 are from Rangoon.
- Figs. 8-9. *Streptaxis Blanfordianus*, Theob., p. 163, front views of two specimens, enlarged twice the natural size, 8 is from Arracan, 9 from Pegu.
- Fig. 10. *Streptaxis solidulus*, n. sp., p. 166.
- Fig. 11, 12, 13. *Strept. obtusus*, n. sp., p. 166.
11 and 11*a* side and lower views, natural size; 11*b*, front view, twice the natural size; 12 natural size of a full grown specimen; 13, 13*a*, 13*b* young specimen.
- Fig. 14. *Strept. Sankeyanus*, Bens., p. 167. 14, 14*a* and 14*b* are of natural size, 14*c* and 14*d* enlarged.
- Fig. 15. *Strept. Hanleyanus*, n. sp., p. 168. The outline figure 15 shews the natural size of the specimen, the other figures are enlarged.





Pl. VIII.

Figs. 1 and 2 exhibit the anatomy of *Strept. obtusus*, (see p. 161); the letters have the following significations:

<i>f.</i> —foot.	<i>h.</i> —heart.
<i>mt.</i> —mantle.	<i>li.</i> —liver.
<i>ml.</i> —mantle lobes.	<i>i.</i> —intestines.
<i>rp.</i> —penis retractor.	<i>c</i> is the cavity where the generative organs were originally situated.
<i>p.</i> —penis.	<i>st.</i> —stomach.
<i>vd.</i> —vas deferens.	<i>ng.</i> —nervous ring.
<i>o.</i> —ovum.	<i>t.</i> —eye-pedicles.
<i>ut.</i> —uterus.	<i>roe.</i> —retractor of the mouth.
<i>rs.</i> —receptaculum seminis.	<i>ac</i> —tube including the radula.
<i>alg.</i> —albuminous gland.	<i>oe.</i> (in figure 2)—ditto.
<i>hd.</i> —hermaphrodite duct.	<i>rm.</i> —chief retractor of the radula.
<i>hg.</i> —hermaphrodite gland.	<i>ad.</i> —anal albuminous gland.
<i>a.</i> —anus.	<i>sg.</i> —salivary glands.
<i>ko.</i> —kidney opening.	
<i>l.</i> —lungs.	
<i>kd.</i> —kidney duct.	
<i>k.</i> —kidney	

Fig. 3 shews the general arrangement of the teeth on the radula of *St. obtusus*.

Fig. 6. Side view of *St. Pfeifferianus* from the Nicobars; nat. size.

Fig. 7. Side view of *Ennea* [*Huttonella*] *bicolor*, from Calcutta; twice the natural size.

In figs. 4, 5 and 8 the numbers indicate the distance of the teeth from the centre line.



S. Siegfried, Lith.

1-4. *Streptaxis obtusus*.
5. " *Burmanicus*

6. *Streptaxis Pfeifferianus*.
7-8. *Ennea (Butinella) bicolor*

Colicula.



Habitat : Damotha, prope Moulmein ; raro.

This species resembles in its colouring *Pterocyclus Feddeni*, Blf., but is easily distinguished from it by its thinner and very gradually increasing whorls. The tubular form of these also readily separates the present species from *Cycl. calyx* which has the basal angulation always distinct. The only other allied species is *Pterocyclus cetra*, Benson, which differs by the well developed upper wing of the aperture. In *Inglisianus* the margin of the aperture is simply insinuated, and externally very slightly thickened.

I have associated with this interesting new form the name of J. W. Inglis, Esq., Executive Engineer at Moulmein, who has most kindly aided me in my conchological inquiries about that station.

***Pterocyclus ater*, Stol., pl. vi, fig. 2.**

Pt. testa orbiculato planorbulari, latissime umbilicata ; apice vix exserto ; anfractibus quinis, depressiuscule teretibus, sutura profunda junctis, liris spiralibus tenuibus, plus minusve distincte setiferis, subdistantibus, ornatis, sub epidermide lividis, transversaliter fulguratim castaneo notatis, epidermide scabriuscula, transversim conferte striata, indutis ; ultimo anfractu ad aperturam sensim descendente ; apertura obliqua, circulari, peristomate duplici, interno paululum crassiculo, ad suturam emarginato, externo tenui, dilatato, supra in alam angustam, curvatam, atque ad anf. penultimum leviter affixam expanso, pone alam perforato. Diam. maj. 16·5, d. min. 13·5, alt. tot. testæ 7·2, axis 3·2, diam. diag. apert. cum perist. 6 mm.

Operculum orbiculare, supra lamellis spiralibus exstantibus, distincte denticulatis, compositum, infra lævigatum, volutionibus angustis spiralibus concentrice minute striatis.

Animal fere uniforme atrum, corpore supra, tentaculis ad terminationem et pede lateraliter ad marginem inferiorem paulo palidioribus ; forma ab ceteris speciebus ejusdem generis haud distincta.

Hab. Kuengan, ad flumen Ataran, prope Moulmein ; cepit Theobald.

This is a very interesting planorboid and spirally lirated species. The outer lip is at the suture produced in a narrow obtuse wing,

curved towards and loosely attached to the previous whorl, leaving a rounded circular foramen behind it. The whorls of the operculum are above peculiarly dentate.

RHIOSTOMA HAUGHTONI, Bens.

An. and Mag. Nat. Hist., 3rd ser., V, p. 96.—Reeve Iconica, vol. XIV *Pterocyclos*, pl. V, fig. 30.—Hanley and Theobald, Conch. Ind., pl. V, fig. 10.

Young specimens have no trace of the upper notch at the outer lip and are generically undistinguishable from the planorboid *Cyclophori*, like the Ceylon *C. annulatus*, Trosch., or the Nilgherry *C. ravidus*, Bens. Only in full grown specimens, the last whorl at the aperture becomes detached from the previous whorl. The operculum is first thin, flattened outside and slightly concave inside; gradually the shape becomes convex outside, as the whorls increase in number, and at the same time the internal concavity enlarges.

The animal is quite similar to that of *Pterocycclus*: it is dirty white, with darker minute spots on the back, translucent pinkish between the tentacles and partially on the front side of the foot; tentacles of moderate length, blackish, paler at the tips which are hardly swollen; the edge of the mantle fits very closely to the shell, it is somewhat thickened, and has a small slit corresponding to the upper tube-like incision on the outer lip; the sides of the slit are very extensible and secrete the tube. Young specimens generally possess a distinct pinkish white tint on the entire body.

Hab. At Damotha, (N. E. of Moulmein), on limestone rocks; found under decaying leaves and humus. The animal appears to be more nocturnal in its habits, than the true *Pterocyccli*, and is very shy.

Fam. *PUPINIDÆ*.

POLLICARIA GRAVIDA, (Bens.).

Hybocystis gravis, Bens., vide Pfeiff., Mon. Pneumonop. viv., suppl. 2nd, p. 56.—Hanley and Theob., Conch. Indica, pl. 7, fig. 1,* *Megal. gravidum*, Bens.

The peculiarity of this genus rests, I believe, chiefly in the remarkably flattened growth of the last and penultimate whorls of

* This figure is somewhat incomplete; it does not shew the short open canal above the posterior angle of the mouth. The position of the operculum in the aperture is not correct. It should rest on the internal swelling close to the margin of the outer lip of the aperture.

the shell, a character specially pointed out by Gould in his brief description, and there can be, therefore, no distinct objection as to the priority of Gould's generic appellation. In my forthcoming "Monograph of the Indian CYCLOSTOMACEA," I will give illustrations of the very peculiar progress in the growth of the shell of this species.

Animal resembling a gigantic *Diplommatina*, of a pale fleshy colour, transparent pink at the rostrum. The foot is short and stout, below at the middle of the sole entire; the rostrum short, thick, deeply cleft at the front end; the tentacles are of moderate length, attenuated towards, but somewhat obtuse at, the tip itself, of a pale grey colour; the eyes are small and placed laterally at their bases on minute bulgings. The sexes are, as usually, distinct, and the copulative organ of the male is situated laterally, somewhat in front of and almost immediately below the right eye.

Habitat. Common on the limestone hills at the "Farm-caves," and at Damotha. I have not met with a single specimen on the hills south of Moulmein.

RAPHAULUS CHRYSALIS, Pfr.

I have only obtained a single live specimen at the Farm-caves, near Moulmein. The animal was pale greyish white with a slight fleshy tinge; tentacles rather long and pink; rostrum stout, the red oral parts shining through at its base, its front edge is slightly lobed. There is a regular canal leading from the pulmonary cavity backwards, then piercing the mantle and entering the tube which runs again forward on the internal side of the last whorl below the suture, until it terminates in the external apertural tube. The form of this tube is different from that of *Pupina* or *Alycæus*, but it is very much the same as in *Streptaulus*. (Comp. Blanford in A. and Mag. N. H., 3rd ser., xii, p. 55).

PUPINA ARTATA, Bens.

Hanley and Theobald, *Conch. Indica*, pl. vii, 5.

This species is common on all the limestone hills about Moulmein. The animal is whitish or pale grey, sometimes darker at the sides of the foot which is moderately elongated and

posteriorly pointed. Tentacles blackish, thin and subulate in young, considerably thicker in older specimens; eyes rather large, black, placed laterally and somewhat posteriorly on distinct bulgings at the base of the tentacles; rostrum rather short, slightly cleft in front, the buccal parts red, shining through; mantle with a small slit on each side corresponding to the incision in the shell, the lower edges of the slits are slightly thickened and rather distinct, the upper almost perfectly continuous with the outer, slightly thickened, edge of the mantle.

The horny, moderately thickened, operculum closes the aperture perfectly; it has a thin fringe at its edge all round and is externally slightly impressed in the centre. The live shell is covered with a thin layer of slippery glaze. Young shells are regularly coiled, like a little conoid *Helix*, and quite transparent. There is no difference in the coloration of the sexes.

Fam. DIPLOMMATINIDÆ.

Sub-fam. DIPLOMMATININÆ.

Diplommatina carneola, Stol., pl. vi, fig. 3.

Diplommatina testa ovato elongata, turrita, vix rimata, carnea, seu carneo-luteola; anfractibus 7, valde convexis, suturis profundis junctis, primis duobus lævigatis, luteis, ceteris costulis obliquis, modice distantibus, ornatis, penultimo maxime inflato, ad terminationem valde constricto, ultimo minore, ad basin rotundato; apertura rotundata, marginibus paulo dilatatis et incrassatis, ad anfractum penultimum conspicuiter ascendentibus, intus lævigatis: labio adnato, paulo expanso, labro duplici, extus prope marginem costa tenui et acuta instructo, collumella fere recta, infra dente unico instructa, ad basin vix angulata. Diam. anf. penult. 1·2; alt. tot. testæ 2·6, apert. alt. 0·8, ejusdem diam. 0·8 m.m.

Animal carneo-luteolum, tentaculis, rostro ad terminationem, interdumque dorso supero, plus minusve distincte atratis; oculis magnis in latere basali tentaculorum sitis, atris, pede angusto, postice acuminato; operculum corneum, tenuissimum, concentrice multi-spiratum.

Hab. Damothes, prope Moulmein.

This species is somewhat allied to *D. Puppensis*, Blf. (Journ.

Asiat. Soc. XXXVII, pt. II, pl. iv, fig 2), differing from it by its constant smaller size, more tumid or convex, and more widely costulated whorls, and by the aperture being at the columellar base rounded or nearly so, instead of deeply angular and canaliculate, as it always appears to be in *Puppensis*.

The present species was found to be very common on the perpendicular limestone cliffs at Damotha, especially in localities where a little water trickled down the rock. The animals seemed to feed on the minute algæ which were growing in the locality.

Diplommatina [Palaina] *crispata*, Stol., pl. vi, fig. 4.

Diplommatina [Pal.] testa conoidea, medio latissima, sordide albida, anfractibus 7, primis duobus (rare $1\frac{1}{2}$) mammillatis, lævigatis convexis, sequente convexiusculo, confertim lamellose striato, ceteris medio angulatis, crasse lamellatis, lamellis crebris, inæqualibus, tenuibus, undulatis et crispatis, ad peripheriam angulosam spiniforme productis, latere interiore excavatis; anf. penultimo haud distincte constricto; ultimo angustiore, basi convexiusculo; apertura perobliqua, circulari, extra dilatata, intus continua, lævi, supra leviter adnata, ad latus columellare incrassata et infra dente pliciforme, vix distinguendo, instructa, margine interno acuto, undique libero; peristomate externo tenui, lamelliforme undulato et late expanso. Alt. testæ 2·5; diam. anf. penult. (spinis incl.) 1·5; diam. apert. int. 0·8, d. ap. cum perist. 1· m.m.

Animal albidum, tentaculis cinereo atratis; operculum corneum.

Habitat. Damotha, prope Moulmein; rarissime cum precedente.

This is the first species from British India referable to the subgenus *Palaina* of Semper (vide Journ. de Conch. 1863, p. 291, and 1866, p. 348), although, if the subgenus should be retained, it cannot include all the species referred to it by its author. The various subdivisions of *Diplommatina* appear to me to have been suggested more with a view to geographical distribution, than to the necessity of conchological grouping. Whether the shells are coiled to the right or left constitutes no generic difference in *Diplommatina*, as it does not in cases of *Helix* or *Bulinus* &c., even as regards specific distinction.

The peculiar characteristic of *Diplommatina* lies in the very marked constriction of the penultimate whorl, (compare Journ.

Asiat. Soc. Bengal, vol. XXXIX, pt. II, pl. ii, fig. 3-5), in the short internal parietal rib just at the beginning of the last whorl, and in the twisted columella which terminates in the aperture with a tooth, sometimes placed so far internally as to be hardly visible, but very rarely becoming nearly obsolete. In addition to these characters the typical species have the whorls either partially or wholly transversally costulate or striated, and the shell itself is of a moderately solid structure.

Semper instituted the genus *Palaina* for a number of Philippine species, some of which, like *P. polymorpha*, *P. strigata*, and others (see J. de Conch. 1866, pl. ii and x,) do not in any way differ from typical Indian *Diplommatinæ*. In other species, noted by Semper, as for instance in *P. pupa*, *patula*, *Wilsoni*, &c., the general character of the shell is the same, the constriction more or less distinctly marked, but the columellar tooth is not visible. The same can be observed in some allied Himalayan forms, as *D. Huttoni* or *costulata*, though looking into the aperture obliquely, the abrupt termination of the columella may, for instance in the last-named species, be readily seen. I do not think it, therefore, improbable that the terminal twist and truncature of the columella also exists in these Pelew, or Philippine, *Palainæ*, in which case there would be no reason whatever to separate them generically, or subgenerically, from *Diplommatina*.

Other species, again, like *Pal. pyramis*, *alata* and *lamellata* of Semper (l. cit.) are distinguished by a round, almost tubular aperture, with a free sharp continuous margin, being internally conspicuously thickened and obliquely placed towards the axis of the shell; the whorls are ornamented with transverse lamellar ribs, mostly projecting at the middle, the penultimate whorl is not distinctly constricted, and the columellar tooth is in some visible, in others not, though I have little doubt but that in all the columella is twisted and in the interior of the aperture truncated. For this group the name *Palaina* may be retained, but *only* as a subgenus of *Diplommatina*; for on comparing species like Blanford's *D. exilis* from Ava, it will be readily seen how closely connected all these forms are.

For Mousson's *Pupa problematica*, from the island Upolu, Semper proposed the subgeneric name *Moussonia*, changing (why?) the specific into *typica* (comp. J. de Conch., 1865, p. 296, and 1866, pl.

x, fig. 9). This species has the general form, usual costulation of the whorls, and the columellar tooth of *Diplommatina*, but no apparent constriction at the termination of the penultimate whorl. Only if this last character should prove constant, could the subgeneric name be retained, though this seems to be rather doubtful. Mousson recently (J. de Conch. 1870, p. 188, pl. viii, fig. 9), described from one of the Viti islands a *M. fuscula*. It is about as much elongated as the type species, smooth, but the constriction on the penultimate whorl is distinctly perceptible; therefore this species does not differ in any essential point from *Diplommatina*.

In 1864, E. v. Martens suggested the name *Diancta* for a sinistrorse species from Ternate, distinguished by a very marked constriction of the penultimate whorl, hence the specific name *D. constricta* (vide Moll. der Preuss. Exp. nach Ost-Asien, p. 164). The same author states (ibidem) that *Diplommatina* has no columellar fold, which is evidently a mistake, for its existence had been recorded in many of the Indian species then known, but no figures were published. *D. constricta* does not possess a columellar fold or tooth; it is probably situated far internally, but the constriction evidently indicates that the columella must be strongly twisted. Besides Adam's *Diplommatina Martensi* there have been (J. de Conch. 1870, p. 180 et seq., pl. viii,) several species lately described by Mousson under the subgeneric name *Diancta*. They are all sinistrorse, like the Indian *D. gibbosa*, Blf., but in no other respect generically, or even subgenerically, different from *Diplommatina*.

In connection with these various forms of *Diplommatina* I must mention H. and A. Adams' genus *Paxillus*, proposed for a species from Singapore, *P. adversus*. The columellar fold is strong and the constriction distinct in this species, as well as in Martens' *P. rubicundus*. I do not see any characters by which these shells could be separated from *Diplommatina*. Gould's two Chinese species referred to *Paxillus* are too insufficiently characterized to admit of a correct opinion being formed regarding them.

In conclusion I have to allude to the subgenera *Arinia*, H. and A. Adams and *Nicida*, Blanford. Of the former Sowerby's *Cyclostomus*, from the Philippines, has been considered as the type, and another allied species, *A. scalatella*, was described by Dohrn from

Luzon, (vide Journ. de Conch. for 1866, p. 352). *Arinia* are small shells, allied to *Diplommatinæ*, but of a thin structure, with smooth, or nearly smooth, surface, without a distinct constriction on the penultimate whorl, and without a fold on the columella.

Mr. W. T. Blanford (Journ. Asiat. Soc. xxxvii, 1868, p. 82, and also Journ. de Conch. for 1868) proposed the name *Nicida* for six species from South India. Three of these *N. Pulneyana*, *liricincta*, and *Kingiana*, do not externally appear to offer any generic, or sub-generic, distinction from *Arinia*. In all these the position of the small operculum when retracted is exactly the same as in *Diplommatina*, and the same internal parietal plait exists at the beginning of the penultimate whorl; the columella is twisted, with a fold, but the latter becomes obsolete at the aperture, not terminating in a tooth. Mr. Blanford, therefore, very properly stated that *Nicida* must only be considered as a subdivision of *Diplommatina*, on which point there can be no doubt. I have seen the animal of *Nic. liricincta*, and it is exactly like that of *Diplommatina*. It does not appear to me at all improbable that *Arinia* and *Nicida* will have to be united into a single subgenus; Sowerby's figure of *minus* is rather in favour of this view, but I have not that species for comparison and in order to settle the relation which is supposed to exist between *Arinia* and *Nicida*, it is absolutely necessary that the internal structure of the ultimate and penultimate whorls of the two species of *Arinia* be compared with these same parts of the shell of *Nicida*. If a twisted columella and a parietal rib do not exist in *Arinia*, the genus will have probably to be placed near *Callia* and *Streptaulus* in the PUPINIDÆ.

With regard to Mr. Blanford's three other species of *Nicida*: *N. nitidula* shews a very slight constriction of the penultimate whorl, and *Nilgirica* (the type) and *Fairkanki* have it very distinctly developed externally. They, therefore, only differ from *Diplommatina* by the thin structure of their shells, and by the want of transverse costulation on the whorls.

To sum up—we have in the *Diplommatina* group of PNEUMONOMA, 1st, the genus *Diplommatina*, with the subgenera (a) *Palaina* (of the type of *P. pyramis*, Semp.), (b), *Moussonia*, (with the type *Mouss. problematica* (alias *typica*), the subgenus being only admissible,

if the penultimate whorl has no trace of a constriction,—(c), *Diancta* (with the only species *D. constricta*), only admissible if there be no tooth or truncate columella in the aperture; (d), *Arinia* (type *A. minus*) and (e), *Nicida*, Blanf. (type *N. Nilgirica*), the latter admissible as distinct from the former, if *Arinia* has no internal parietal plait and the columella not twisted. Mousson's numerous species of *Diancta* are certainly nothing but *Diplommatinæ*, and I also very much doubt whether there is sufficient reason for retaining *Paxillus* as distinct from *Diplommatina*.

2nd, *Clostophis* of Benson. I have not been successful in the discovery of a specimen at the Farm-caves, or in any other locality about Moulmein.

3rd *Opisthostoma*, Blanf., is a good distinct genus of the DIPLOMMATINIDÆ.

Sub-fam. ALYCÆINÆ.

The only interesting species, which I found on the limestone hills south of Moulmein, is the very rare *Alycæus Richthofeni*, Blf., (Contrib. Indian Malacol., No. 4, Journ. A. B. for 1863, vol. xxxii, p. 324). Only a single specimen occurred. Blanford's description is excellent.

Fam. HELICINIDÆ.

Sub-fam. HYDROCENINÆ.

*Georissa** *liratula*, Stol., pl. vi, fig. 5.

Geo. testa globoso-conica, solida, imperforata, carneo-luteola; anfractibus 3 - 3½, convexis, sutura profunda simplici junctis, primo apicem subobtusum formante mammillato, lævigato, luteolo vel rubescente, cæteris supra (infra suturam) paululum depressiusculis, spiraliter liratis, liris acutis, simplicibus, fere æquidistantibus, in anf. penultimo 6-7, in ultimo 9-10, basi convexa, centraliter minute multistriata; apertura semilunari, altitudine fere spiram æquante, haud dilatata; labro simplici, curvato, intus striato, labio incrassato, albedo, adnato, intus rectiusculo, lævi. Operculum testaceum, tenue, diaphanum, latiuscule semilunare, (nucleo excentrico),

* I prefer keeping *Georissa* as distinct from *Hydrocena* in the hope of examining the animals of both the typical species at an early date. For the relation of the two genera vide W. Blanford in Ann. Mag. Nat. Hist. for November, 1870.

striis incrementi rugulosis vestitum, intus ad nucleum apendice tenui, longo, lateraliter sub marginem columellarem projiciente, instructum.

Diam. maj. 1·8, d. min. 1·5, alt. testæ 2·2, alt. ult. anf. ad aperturam fere 1·0, lat. apert. 0·7 m.m.

Animal sordide rubescente albidum, rostro lato, nigricante, tentaculis brevissimis, vix projicientibus, latis, medio fere confluentibus, oculos parvos supra, ad basin et paulo lateraliter sitos, gerentibus; pede breve, subovato, pallido.

Habitat. Damotha, prope Moulmein, frequens.

I found this species common on the limestone hill near Damotha together with *Diplommatina carneola*, and others. It is mostly allied to the Khasi hill species *G. sarrita*, Bens., but is more globose and a little more numerous spirally ribbed. It also appears to be closely allied to Benson's *G. Rawesiana* (Ann. and Mag. N. H., 3rd ser., vol. vi, p. 193), but on comparing the description of the former it seems unjustifiable to identify both. Benson says: "confer tim spiraliter striata;" this could hardly apply to the rather strong and by no means very numerous spiral ribs of *liratula*. Further Benson says "apice obtuso;" he could hardly have overlooked the mamillate form of the first smooth whorl of *liratula*, forming the apex. I never observed in the last species, four complete whorls which *Rawesiana* is said to possess.

The measurements of both very nearly agree, but *Rawesiana* would seem to be a more slender shell. Benson gives the height of his shell as 2, and the diam. (largest of course) as 1·5 m.m.; in specimens of *liratula* with a height of 2 m.m. the greatest diam. never appears to be below 1·6, generally a little more. There is also no perceptible impression at the umbilical region in *liratula*. In other respects both species appear fairly to agree.

Georissa Blanfordiana, Stol.; pl. vi, fig. 6.

Geo. testa globoso conoidea, imperforata, moderate solidula, luteola, apice rubescente, mammillato, lævissimo; anfractibus $3\frac{1}{2}$, convexiusculis, transversaliter striis incrementi minutis tectis, sublævigatis; ultimo ad peripheriam rotundato, in altitudine spiram subæquante; apertura late semilunari: labro, uniforme cur-

vato, postice (vel supra) angulata, labio incrassato, levissime arcuato, supra paululum dilatato, infra angustiore. Diam. maj. 1·2, d. min. 1·0, alt. testæ 1·8; alt. ult. anf. ad apert. 0·8; lat. apert. obliq. 0·5. Operculum animalque non vidi.

Hab. "Farm caves" prope Moulmein.

A single specimen of this species was found in the same locality from which *G. Rawsiana*, Bens., was described. It differs from all known *Georissæ* by the absence of spiral striation. The form of the shell is very much the same as that of the previous species.

Group. **HELICACEA.**

Fam. **STREPTAXIDÆ.**

Dohrn in 1866, (Maloco-zoologische Blätter, vol. xiii, p. 129), proposed to unite *Streptaxis*, *Ennea* and *Streptostele* into a separate group, for which he suggested the name STREPTOCIONIDÆ. There does not appear to be any reason, why we should deviate from the generally introduced custom in selecting the family name from that generic one which includes the most typical forms of the group, and this genus is in the present case *Streptaxis*. The family has already been pointed out by Dr. J. E. Gray, in 1860, (Ann. and Mag. N. H., vi, p. 268), under the name STREPTAXIDÆ.

The three above noticed genera, (each of which includes several characteristic sections), have the following characters common: a thin hyaline or a thicker alabastrine shell with very thin, deciduous epidermis, an expanded lip of the aperture, producing in the course of growth a transverse costulation of the whorls, the last of which somewhat deviates from the axis of the spire; the columella is always thickened and often toothed, or provided with a projecting lamella.

Dohrn appropriately pointed out the striking relations of the shells of the three genera by quoting the following parallelism: "*Streptaxis* is helicoid, *Ennea* pupoid, and *Streptostele* achatinoid."

The same author does not describe the animal of *Streptostele* and its anatomy, probably because they are very similar to those of *Streptaxis* and *Ennea*. I have examined several species of the latter two genera, and they all agree in the usual bright, yellow or red colouring, extending over the greater part of the body, or being

restricted to the head; the anterior part of the body is always long, extensible, and the posterior short; the peduncles are long, subcylindrical, but the tentacles much shorter, exactly as in the *HELICIDÆ*. The mantle is thickened, generally with a short lobe, or a thickening, on each side of the pulmonary orifice. The internal organisation closely corresponds with that of the *HELICIDÆ*, except that the œsophagus is below produced in a tough cylindrical tube, which contains the radula in the form of a narrowly curved sheath; the tube is attached by a special strong muscle to the retractor of the body (see pl. viii, fig. 2). The teeth of the radula are very simple, subconical, pointed, from 40-60 in each transverse row. A special jaw is, as far as observations have been made, not developed.

All the species which I have observed were found under stones, or trees, and old wood, or under dead leaves and other organic substances. Whether, or not, the species are carnivorous, as stated by Gray, I have not been able to verify. They are oviparous, like the *Bulimi*.

Considering the form of the teeth, the *STREPTAXIDÆ* are closely allied to the *TESTACELLIDÆ*, next to which they are also classed by Gray. Both families agree in the great length of the anterior part of the body and in the more or less secluded habitat. But upon inspection of the anatomy of *Testacella*, as given by Cuvier, I fail to notice the peculiarity of the long cylindrical tube containing the radula; this appears to be a good reason for accepting Gray's classification of *Testacella*, with *Daudebardia*, in a separate family. A third group containing some of the anatomical characters of *Streptaxis* is represented by *Glandina*, but *Cylindrella* and its allies belong to the *HELICIDÆ*, as lately shewn by Crosse and Fischer.

STREPTAXIS, Gray.

This genus characterizes in India the Malayan fauna, most of the species being found either on the higher hills of South India, or in North-Eastern Bengal, and from thence southwards through the whole of Burma and the Tenasserim provinces. The greater number of the species, occurring in this extensive zoological province, are distinguished by a single parietal plait in the aperture, only

few possess also small teeth on the outer and columellar lips. The same group of *Streptaxis*, with a single parietal fold, also extends to the islands of the Indian Archipelago and to China on the one, Mauritius and the Seychelles on the other hand.

The animals of *Streptaxis* are characterized, as already noticed, by the great length of the anterior part of the body,* while the posterior part, or the foot, is very short and often barely protrudes beyond the apex of the shell, when the animal creeps about. The sole of the foot is usually grooved along the middle, but not distinctly.

I am not aware that the anatomy of any of the Indo-Malayan species of *Streptaxis* has been published, and I give, therefore, a short account of that of *St. obtusus* and *Burmanicus*.

St. obtusus. An inspection of fig. 1, on pl. viii, will shew that in the main points the organs are quite similarly arranged as in the HELICIDÆ, only with some modifications adapted to the shape of the animal. The mantle is above, at the pulmonary orifice, considerably produced, receding ventrally, but remaining entire. On the inner side it has near the margin an elongated, thickened appendage on each side of the pulmonary opening. The pulmonary cavity itself is very long, but the lungs narrow, the reticulations being very fine and mostly simple. The digestive system differs from all HELICIDÆ which I have examined, by the peculiar development of the buccal parts. The mouth is wide, and immediately behind it, where it makes an angle, lies the nervous ring, consisting above of two larger, and below of two smaller ganglions, the latter being connected by a narrower bridge than the former. Immediately behind the nervous ring, the buccal parts are produced into a cylindrical muscular tube which extends in a slight curve up to the end of the chief retractor muscle of the body, where it is firmly attached by a special, thick, muscle. A few separated threads connect the mouth direct with the anterior end of the retractor. The ring-muscles forming the outer layer of the tube are almost horny, or at least very tough. The longitudinal muscles forming the internal layer are much softer, but considerably thicker.

* See pl. viii, fig. 6. *Streptaxis Pfeifferianus* from Camorta, one of the Nicobar islands. Body bright yellow, pedicles coral red, this colour tinging the back. Lives under dead leaves in forests.

The radula is very long, but the teeth are generally only on its anterior portion well developed. The alimentary canal branches off near the upper anterior end of the sheath of the radula; a short distance from its origin it is somewhat widened and then passes into the stomach, which has no appendages. The intestines make only one simple turn. The rectum is accompanied by a narrow albuminous gland, which has its duct at the lower end of the rectum. Salivary glands moderately broadly linguiform, thin, each attached by a long thread behind the issue of the œsophagus from the sheath. Kidney large, of a pale livid colour, subquadrangular, lanceolately prolonged on the side of the heart; the duct is on the right side and accompanies the rectum in its entire length, lying on the left side of it.

The retractile muscle of the body is not very long, but strong. Its terminal end is almost quite horny; it is, so to say, the seat in which all muscular action appears to be concentrated. I have already noticed that the mouth is attached by a few direct muscles to the retractor; the same is also the case with the penis retractor and the muscles of the generative organs. The eye-pedicles also have their origin there, joining the retractor at about half its length.

The generative organs are of a simple form. The oviduct is thickened near the end; the uterus, as usually, foliated, terminating with an elongated albuminous gland of moderate size; the hermaphrodite duct very much twisted and long; the hermaphrodite gland small, composed of a cluster of tubes. The receptaculum seminis is small, its peduncle as long as the uterus to which it is grown to almost in its entire length. Vas deferens very short, without any appendages. Penis short, very muscular, attached by a very long thin muscle, almost horny towards the end. In two specimens, (one of *St. obtusus* and the other of *Burmanicus*), I found the anterior end of the uterus somewhat enlarged; it contained a few large eggs. They were perfectly spherical, but as the specimens had been in spirit for a long time, nothing was discernible in the solidified yolk-mass. Each egg was enclosed in a white calcareous skin, which was still quite flexible, but no doubt turns into a solid calcareous shell after it has been deposited. The *Streptaxes*, therefore, appear to be oviparous, like the *Bulimi*, *Achatinæ* and other HELICIDÆ.

I have not been able to find a distinct jaw, either in *obtusus*, *Burmanicus*, *Pfeifferianus* or *Andamanicus*. The upper lip is only slightly thickened on the upper side, where the jaw should be situated.

The radula is long, narrow, the lateral margin on either side curved upward; it is composed of numerous, very angular series of simple, almost straight, sharply pointed, teeth, provided below with a small projection. They are very different from those of the *HELICIDÆ*, but, as already noticed, strongly resemble those of *Testacella*. There appear to be from 40-50 teeth in each row.

The anatomy of *St. Burmanicus* is very similar to that of *obtusus*. A few unimportant differences I shall notice further on. I have also examined *St. Andamanicus* and *Pfeifferianus*, and found their anatomical characters quite similar to those of *obtusus*. The form of the teeth appears to be particularly characteristic.

1. *STREPTAXIS BURMANICUS*, Blf., pl. vii, figs. 5, 6, 7.

1865, J. A. S. B. vol. XXIV, pl. ii, p. 81 and p. 95.—Hanley and Theobald, *Conch. Indica*, pl. viii, fig. 10, (non fig. 5).

2. *STREPTAXIS BLANFORDIANUS*, Theob., pl. vii, figs. 8, 9.

J. A. S. B., vol. xxiv, p. 245, et *Conch. Ind.*, pl. viii, fig. 5, (non fig. 10).

These two species are closely allied to each other. *Blanford's* description must stand as that of true *Burmanicus*, of which fig. 5 pl. vii, represents a characteristic specimen. It is a globosely inflated shell with a subconic, slightly oblique spire, the antepenultimate whorl laterally barely projecting, in a front view, beyond the periphery of the last whorl. In Mr. Theobald's description of *Burmanicus* characters are noticed which only apply to his *Blanfordianus*; the description must have been taken from specimens of both the species. Specimens, agreeing in shape and size with typical forms of *Burmanicus* from Arracan, also occur at Tonghoo, where they were collected by Mr. Theobald, (see pl. vii, fig. 5). On the hill of the great Pagoda at Rangoon, I found a smaller variety. Two forms of this latter are represented in figs. 5 and 6. The aperture is slightly more produced and narrower, but the characteristic form of the whorls and their volution are retained.

The animal has the anterior part of the body, as usually, very

long and the foot posteriorly very short and depressed, below with a median, slight, groove. The general colour of the body is yellowish, with small brownish warts and some indistinct striæ above, towards the head vermilion red; pedicles vermilion, long, with the eyes on rather large bulgings; tentacles short and paler red. The lips of the mouth possess above small protuberances which are used as tasters when the animal moves about; foot narrow, white; edge of mantle very pale yellowish.

The upper portion of the mantle has internally on the left side of the pulmonary opening a double appendage: externally a small rim and next below it a longer linguiform appendage. On the other side of the pulmonary orifice there is a similar appendage, only a little shorter than the last. Both are tough, solid and generally of a brownish colour. Besides this there is a small appendage at the umbilical region. The general organisation is the same as in *obtusus*, only the receptaculum seminis is thinner and smaller, the vas deferens longer; the salivary glands are larger and broader, the albuminous gland is elongately and somewhat irregularly ovate, it lies at the beginning of the rectum and does not extend along it; the kidney is elongately quadrangular, slightly produced on the anterior end of the side of the heart; it is of a dark green colour, composed of large, (in spirit specimens) quite opaque, cells.

The teeth are very similar to those of *obtusus*, perhaps a little stouter, (see pl. viii, fig. 5).

In the "Conch. Indica" the two species have been exactly transposed. Fig. 5, which is cited as *Burmanicus* is a typical form of *Blanfordianus*, on the contrary, fig. 10 which is stated to be the last named species appears to be taken from a Rangoon variety of *Burmanicus*. Such mistakes in a work specially devoted to illustrations of Indian shells are really deplorable!

St. Blanfordianus is distinguished from *Burmanicus* by a more depressed and elongated form, the last whorl being more obliquely extended, so as to allow the previous one considerably to project with its rounded edge beyond the periphery of the last whorl. The spire is in the former species generally slightly prominent, but the costulation of the whorls more crowded and intersected by mere striæ, except

towards the aperture; the size is also smaller. Mr. Theobald's typical specimen had beside the parietal fold a small tooth about the middle of the inner side of the outer lip, as shewn in fig. 8; this specimen perfectly equals in size the type. However, the tooth on the outer lip, upon which Mr. Theobald strongly relied as a distinctive character, is not constant. I found a specimen exactly similar to the type on the Rangoon Pagoda, but without an outer tooth; and quite similar specimens have also been collected by Mr. Fedden in the Shan States. The same, but slightly larger, variety occurs in Pegu; this is represented in fig. 9, pl. vii. Its only difference consists in size, approaching that of *Burmanicus*.

Mr. Blanford (l. c. p. 95,) considered the form, called by Theobald *Blanfordianus*, as identical with Benson's *Andamanicus*, and both certainly are most closely allied to each other. I possess numerous specimens of the last species, and most of them seem, as compared with *Blanfordianus*, a little more longitudinally stretched; all have the spire peculiarly depressed,* the whorls being separated by rather deep sutures, and are somewhat convex above; the costulation also appears to be a little coarser and the umbilicus more spacious; but all these distinctions are only relative, and it is very difficult to appreciate them without a large number of specimens for comparison.

The animal of *Blanfordianus* is very similar to that of *Burmanicus*, except that the yellow and red colours are paler. The comparative measurements† of the two species are:

	<i>Burmanicus.</i>		<i>Blanfordianus.</i>		
	Typical.	Var.	Typical.	Var.	Var. mag.
Diam. maj.,	10·5	8·8-8·6	7·3	7·6	9· m.m.
„ minor,	7·6	6·5-5·8	5·	5·	6·2 m.
Altitudo,	9·	6·2-6·6	5·	5·4	7· „
	~~~~~		~~~~~		
	Arracan.	Rangoon	Pegu.	Shan	Pegu.
		Pagoda.		States.	

* Fig. 6, pl. viii, given in the "Conch. Indica," is in this respect not a characteristic one.

† In taking the height of *Streptaxis* the shell is placed in such a position that the axis of the upper regularly coiled whorls stands vertical, the two last whorls always somewhat deviate from the direction of this axis.

***Streptaxis solidulus*, Stol., pl. vii, fig. 10.**

St. testa ovato-conoidea, moderate umbilicata, albida, solida; anfractibus 7, primis 5 regularibus, spiram exsertam, late conicam, formantibus, duobus ultimis modice deviantibus, omnibus planiusculis, seu subconvexis, sutura impressa simplici junctis, transversim conferte costulatis: costulis flexuosis, in ultimo anfractu distantioribus, basi obsoletis; apertura late subquadrangulari: labio tenui prope medium uniplicato, labro intus levi, undique planate reflexiusculo; diam. maj. 12, d. min. 9·3, axis 9, alt. testæ 11·2, lat. aperturæ, marg. incl., 7·2, alt. ap. 5·2 m.m.

*Hab.* Prope Moulmein, provincia Tenasserim.

A moderately large tumid and solid form, with rather flattened whorls and a prominent broadly conical spire; the first two whorls are generally quite smooth, the remaining transversely costulated, the ribs being on the last whorl a little more distant from each other, than on the previous ones; on the base they become quite obsolete.

Only a few specimens were found by Mr. Theobald at Yethebiankoo on the Attaran river, south-east of Moulmein.

***Streptaxis obtusus*, Stol., pl. vii, figs. 11, 12, 13, and pl. viii, figs. 1-4.**

St. testa oblique ovata, tumida, apice obtusa, antice sensim attenuata, perforata; anfractibus 7, quinque superioribus regularibus, supra convexiusculis, antepenultimo paulo obliquo, ultimo modice deviante, aperturam versus compressiusculo; periphæria in junioribus (fig. 13) rotundate subangulata, in adultis fere uniforme convexa; anf. omninis suturis impressis junctis, in superficie arcuatim conferte costulatis: costulis ad basin (in junioribus depressiusculam, in adultis convexiorem) obsoletis; umbilico ad marginem rotundato; apertura obliqua, postice (aut supra) lata et recta, antice (vel infra) fere uniforme angustatim rotundata; labio tenui, plica una parietali subcentrali instructo; labro incrassato, externo paulo arcuato, intus ad medium obsolete dentato, columellari rectiusculo, supra medium distincte dentato.

	<i>Adult fig. 11.</i>	<i>Jun. fig. 12.</i>
Diam. maj. ....	10·4	9·3 m.m.
„ minor, ....	7·2	6·4 „
Altitude, ....	9·6	7·8 „

*Hab.* Prope Moulmein, provincia Tenasserim.

This species is readily recognised from others by its remarkably obtuse, almost pupoid form, and comparatively regular growth of the whorls; there is a distinct tooth on the columellar lip present, and another tooth is generally also traceable on the opposite outer lip, though not so well defined as the former. In younger specimens the penultimate whorl is subangulate at the periphery and laterally somewhat projecting, but in older shells this angulation generally becomes less distinct and often quite disappears. The whole shell is densely costulated except at the base, where the ribs are only traceable in the umbilical cavity.

The animal is pale yellow with a beautifully yellowish red tinge on the upper anterior part of the body, which is, as usually, much longer than the posterior; the pedicles are also red, and the tentacles paler and very short; edge of mantle considerably thickened, whitish. Other details have already been recorded in my observations on the anatomy of the genus.

The species has been found on the limestone hills south of Moulmein, where it does not appear to be rare. Young specimens, as long as the whorls are regularly coiled, closely resemble Benson's *Helix bombax*, (Ann. and Mag. N. H., 3rd ser., III, p. 186), but they do not possess such a great difference between the longer and shorter diameter, as given by Benson of *bombax*, (no doubt a young *Streptaxis*), in which the inner whorls are much closer wound (compare Conch. Indica, pl. XXXI, figs. 1 and 4). An illustration of a young shell of *St. obtusus* is given on pl. vii, fig. 13; the peristome is slightly reflected.

##### 5. STREPTAXIS SANKEYANUS, Bens., pl. vii, fig. 14.

1859, Ann. and Mag. Nat. Hist., 3rd ser., III, p. 472.—Hanley and Theobald, Conch. Ind., pl. viii, fig. 72.

The characteristic given by Benson is excellent; it is not necessary to repeat it. The species is readily known by its strong carina-

tion of the ante-penultimate whorl and its solid structure; it is waxy yellow when fresh and the fine costulation does not become obsolete at the base, as usual in other allied species. The largest specimen measures: diam. maj. 11, min.  $7\frac{1}{2}$ , alt. 8 m.m.

The figure in Hanley and Theobald's "*Conch. Indica*" does not appear to represent this species, but rather the next. The upper side of the penultimate whorl is never so gibbous and the aperture, I believe, never so truncate and biangular in front, as shewn in that figure; it is moreover always narrowly rounded.

The young shell consisting of the first 5 whorls is, as usually, quite regularly coiled, carinated at the periphery, and only distinguished from similarly formed species of *HELICIDÆ* by having the outer lip above always somewhat produced and peculiarly sinuous.

The animal is uniform pale yellowish white, often slightly more yellowish on the fore part of the body.

*Hab.* This species was met with only on the limestone hills at the so-called "Farm-caves," the original locality where it was described from.

##### 5. *Streptaxis Hanleyanus*, Stol., pl. vii, fig. 15.

*Streptaxis testa parva, oblique elongata, angusta, profunde ac late umbilicata, griseo albida; anfractibus  $6\frac{1}{2}$ , supra et infra striis filiformibus, arcuatis confertisque tectis, primis circ. quatuor, spiram sub-conoideam formantibus, regulariter involutis, antepenultimo ad peripheriam acute carinato, duobus ultimis valde deviantibus, et lateraliter productis; basi subangulato convexa; apertura fere rectangulariter elongata, angusta: labio parietali tenui, medio lamella valde projiciente instructo, labro paulo incrassato, undique reflexo, intus lævigato, supra prope suturam conspicuiter insinuato; diam. maj. 7·5, d. min. 4·8; axis 3·5, alt. testæ 4·5; lat. apert. marginibus inclus. 4·2, alt. apert. 2·2 m.m.*

*Hab.* Prope Moulmein, ad flumen Attaran.

I have only lately received a single specimen of this interesting species through Mr. Theobald. It is allied to *St. Sankeyanus*, and it does not appear improbable that Hanley and Theobald's fig. 7,



on pl. viii., in the "Conch. Indica," rather represents the present species than the former, although it is very difficult to form a correct idea from such an insufficient illustration, as that given in the above quoted work. The form of the aperture and the natural size of the shell, noted by Hanley and Theobald, certainly do not in the least agree with Benson's *Sankeyanus*.

*St. Hanleyanus* is not only a smaller and more depressed shell, than the last, but it is very much narrower, with the last whorl more largely umbilicated, the aperture being also longer and more regularly rectangular. The whorls are finely costulated above and below in both species.

Genus. *ENNEA*, H. and A. Adams.

Sub-Genus. *HUTTONELLA*, Pfr.

If we consider *E. bicolor*, Hutton, as the type of *Huttonella*, this sub-genus includes a small number of *Ennea*, possessing a more or less sub-cylindrical form and four pliciform teeth in the aperture. Two of the teeth are placed at each side of the prosterior (or upper) angle of the mouth, producing a sort of a canal, in which terminates the pulmonary orifice and the anus. The columellar fold is peculiarly flattened and projecting, somewhat resembling the columellar expansion of *Clausilia*; the fourth tooth is usually small, situated at the base of the outer lip. Most characteristic are the two folds, or teeth, at the posterior angle of the aperture.

1. *ENNEA* [*HUTTONELLA*] *BICOLOR*, Hutton, pl. viii, fig. 7-8.

Pfr. Mon. Hel. Suppl. V, p. 456.

Burmese specimens from Rangoon and Moulmein are quite identical with those found about Calcutta and India generally, and the Ceylon and Mauritius form certainly does not differ specifically from them. Some shells appear to attain sooner their adult state than others, having the aperture perfectly developed with a length of only  $3\frac{1}{2}$  m.m., others grow up to 7 and 8 m.m. The identity of *Ennea bicolor*, with *E. mellita*, Gould, and *Ceylanica*, Pfr., can hardly be disputed. The supposed peculiarity, pointed out by Pfeiffer in the last named species, and referring to the shortness of the last whorl, is by no means constant in Ceylon and South

Indian specimens. The denticulations near the suture are generally distinct, but in large specimens they often become almost obsolete. I doubt even that Pfeiffer's *E. Pirriei* is anything more than a large *bicolor*. The short stout form called by Martens, (Ost. Asiat. Moll. p. 384), var. *abbreviata* I have obtained at Singapore; it has a thin, almost hyaline structure, but the whole character is, no doubt, that of *E. bicolor*.

The animal has a long body, laterally strongly compressed, posteriorly shortened, though on the whole a little more produced than in *Streptaxis*, more or less distinctly yellowish; on the head reddish; pedicles long, slightly thickened at the end, their external skin is yellow, but the internal eye-bearing peduncles are vermilion, eyes very small; tentacles small, pale reddish; mantle deep red, and so is also the whole of the internal lining of the shell which exhibits the same, deeper, or brighter red colour as soon as the animal moves about. When retracted only the median whorls appear as deep red. Boiling water changes in a moment the red colour to a greenish yellow, spirits of wine does it only gradually. The lateral line of the foot is rather distinct.

The mantle is only slightly swollen on either side of the pulmonary opening, rarely produced into a distinct lobe. The internal anatomy exactly corresponds with that of *Streptaxis*. The pulmonary cavity extends over the two last whorls when the animal creeps about; the distance can be well calculated by the position of the heart which lies at the base of the pulmonary cavity. The uterus consists of more deeply incised lobes than in *Streptaxis*. No jaw has been observed. The radula is very long, the sides curved up like a sheath of a bambú leaf. There are between 80 and 90 transverse series of teeth, arranged in a moderate curve. The centre tooth is short, sharply pointed with a rapidly widened base. The adjoining and following teeth are longer, slightly curved, sharply pointed and with a blunt knob near their bases; their size gradually decreases as they proceed outward. There are only 19 teeth in each transverse series (9—1—9).

The animal of *Huttonella bicolor* lives generally hidden under old wood, stones, and between damp gravel, particularly near the edges of tanks. Its movements are rather rapid. It is spread almost

all over India and Burma and the Malayan Peninsula. I have, however, not obtained it anywhere on the higher elevations of the southern slopes of the Himalayas, and it is probably also absent in the desert country of North-East India.

2. *Ennea* [*Huttonella*] *cylindrelloidea*, n. sp., pl. vii, fig. 4.

*Ennea* testa cylindracea, alba, apice obtusa, medio latissima, basi paulo contracta, anguste rimata; anfractibus 10, convexiusculis, suturis profundis sejunctis, primis tribus lævigatis, hyalinis, ceteris confertim transversaliter costulatis, ultimo ad basin rotundate carinato, prope aperturam dissoluto, paulum descendente; apertura paulo obliqua, rotundate ovata, marginibus expansiusculis circumdata, supra prope angulum posteriorem lamellâ obliquâ crassissimâ, intrante, valde coarctata, dente opposito in labro externo nonnunquam irregulariter mamillato; lamella parietali profunde sita. Altit. testæ 5, lat. ad medium 1·3; alt. apert. 0·9, lat. 0·8 m.m.

Animal lutescente albidum.

*Hab.* Damotha, prope Moulmein; provincia Tenasserim.

This is a very marked form of *Ennea*, readily distinguished from its allies by the cylindric shape of the shell and the separation of the margins of the aperture from the previous whorl; in this respect resembling some of the West Indian *Cylindrellæ*. I found only very few specimens between the roots of plants near the limestone rocks at Damotha, N. E. of Moulmein; the species appears to be extremely rare.

*Fam. PUPIDÆ.*

*Pupa lignicola*, n. sp., pl. vii, fig. 3.

*Pupa* testa breviter tumide-ovata, subconica, cornea, vix rimata, apice obtusa; anfractibus  $4\frac{1}{2}$ , convexiusculis, costulis modice distantibus, transversalibus, paulo arcuatis, nonnunquam striis tenuioribus alternantibus, tectis, ad basin convecam obsoletis; apertura subrotundata: labio tenuissimo, levi; rarissime denticulo parvulo mediano instructo; labro externo tenui, paululum dilatato, edentulo, in anfractum penultimum vix ascendente; columella ad basin sensim expansiuscula, regionem umbilicalem tegente, torta, infra subdenticulata. Diam. maj. 1·5; d. min. 1·2; alt. 2 m.m.

*Hab.* Moulmein, provincia Tenasserim.

The animal is grey with somewhat, darker, very short pedicles and almost obsolete tentacles. The columella of the shell is at the base peculiarly expanded, flattened, somewhat twisted, producing at the lower part a small denticle. Out of a great number of specimens only one was met with which has a small tooth about the middle of the inner or parietal lip; its presence, therefore, must be regarded as an exceptional character.

The species was found on old masonry of the great Pagoda at Moulmein, and on the opposite bank of the river at Martaban on similar wooden structures.

**Hypselostoma Dayanum, n. sp., pl. vii, fig. 2.**

Hypselostoma testa minuta, conoidea, solidula, pallide brunnea, apice obtusiuscula, late profundeque perspective umbilicata; anfractibus 4, convexis, suturis profundis sejunctis, primo lævigato, submamillato, ceteris striis incrementi subobsoletis notatis, ultimo maximo, fere plane voluto, supra ad peripheriam subangulato, deinde sensim angustiore et ad marginem umbilici rursus obtuse angulato; apertura fere verticali, vix descendente, conspicuiter dilatata, subcirculari; marginibus junctis, intus crassiusculis et plicose dentatis; labio adnato modice expansiusculo, bidentato, dente superiore majore; labro six-dentato: dentibus duobus in regione columellari sitis subdistantibus, alteris duobus, in margine externo, similariter inter se remotis, sed duobus in marg. basali sitis approximatis, parvis. Diam. maj. 1.1, d. min. 0.8; altitudo 1 m.m.

*Hab.* Damotha, prope Moulmein.

A single specimen of this very interesting species was found together with *Georissa liratula*, *Diplommatina crispata* and *carneola*, &c., &c. on the limestone hill at Damotha. It is the third known species of the genus. In general form it resembles Blanford's *H. Bensonianum* from near Ava, but differs in the shape of the last whorl and in the dentition of the aperture. The latter is in both species almost vertical, not turned entirely upwards, as in the type of the genus, *H. tubiferum*. As regards form, the present species indicates still more distinctly the affinities of *Hypselostoma* to *Pupa*, than does *H. Bensonianum*.

I have not seen the animal of *H. Dayanum*, but that of *tubiferum* was noticed by Blanford, and observed by myself. The specimens I saw were pale grey; they had the eye pedicles rather more elongated than usually in species of *Pupa*, and more resembling those of *Helix*; the tentacles at the base of the rostrum were very minute, both blackish. The rostrum itself is thick and very minutely notched at the front edge. The foot is short, ovately elongated, roundly truncate posteriorly. The animal, when moving, carries its shell in a reverse position (see pl. vii, fig. 1). On the whole it greatly resembles that of *Anostoma*, as figured by Fischer in *Journ. de Conch.* for 1869, Vol. ix, pl. xi, figs. 1-2.

*Fam. CLAUSILIIDÆ.*

CLAUSILIA Drap.

A short time ago only very few species belonging to this genus were known from the Indian regions, but the number is considerably increasing. It is a noteworthy fact that nearly all the species at present on record characterize the so-called Malayan fauna. Several species were lately described by E. v. Martens and others from Sumatra and adjacent islands. I have two new species from Penang; one was recorded by Pfeiffer and Dunker from the Nicobars; a single specimen of a species, apparently identical with one from Penang, was obtained by me on the Andaman islands. From Burma *C. insignis* and *vespa*, Gld., *C. Philippiana* and *Gouldiana*, Pfr., *C. bulbis*, Bens., *fusiformis*, Blf., and *tuba*, Hanley (*Conch. Indica*, pl. xxiv, fig. 9,) were made known. Theobald described *Cl. Masoni*, which with the last mentioned species, belongs to a peculiar type of *Clausilia*, having as its close ally Troschel's *Cl. Peruana*, classed by H. and A. Adams and Albers in the subgenus *Nenia*. Mr. Theobald also obtained about Moulmein and in eastern Pegu several as yet undescribed species. From the Khasi hills, Benson described *Cl. loxostoma*, and *C. bacillum* of Benson was recently figured in the *Conch. Indica*. There are, however, at least three other species* from the same regions, mostly collected by Major Godwin-Austen. *Cl. Jos*, Bens., is from Darjeeling, while *Cl. cylindrica*, Gray, is as yet the

* These and other new species will be described by Mr. W. Blanford, in his forthcoming Monograph of the Indian species of this genus.

only species which extends along the Southern slopes of the Himalayas westwards into the Sutlej valley.

As no anatomical account has yet been published of any of the Indian species, I shall give a few details of *Cl. Philippiana* which, with *Cl. bulbosus*, (? *vespa*), and a small form allied to *Philippiana*, represents a peculiar little group of vespiform *Clausilia* from the neighbourhood of Moulmein.

CLAUSILIA [PHEDUSA] PHILIPPIANA, Pfr., pl. vi, fig. 7-10.

Mon. Hel., vol. ii, p. 423; Küster. Syst. Conch.-Kabinet, *Clausilia*, p. 100, pl. xi, fig. 7-9.

Without Küster's figure it would be difficult to identify Pfeiffer's species, that author's description being in several respects barely sufficient. Pfeiffer says regarding the 6 whorls "primi 3 palaniusculi;" this is strictly speaking not the case; it is the apex which is invariably obliquely flattened or obtuse, but all the whorls are distinctly convex, and the three upper ones almost more so than the following. The top, or embryonal whorl becomes quite solid in adults. Further on, Pfeiffer says: "plica subcolumellaris immersa," while that fold is perfectly distinctly traceable in the aperture.

There are 7 or 8 palatal ribs on the outer lip, the uppermost below the suture is the longest, the following short. The lower palatal plaits become less distinct in old specimens, than they are in the adolescent horny and transparent shells, but they never appear to become obsolete. The other characters relating to the structure and the dimensions, noted by Pfeiffer, agree well with the Moulmein shell, except that the oblique longitudinal diameter of the aperture is rarely 7 m.m.; usually it is only  $6\frac{1}{2}$  m.m. in specimens the total height of which is 21 m.m. Pfeiffer's reference to the relation of *Cl. Philippiana* with *insignis* is not well chosen; few shells could be more different than these two; but judging from the description of Gould's *Cl. vespa*, this form must be very closely allied to *Philippiana*. The description is brief, but there is strictly speaking nothing in it which could not equally well apply to the last named species.

A very closely allied species has also lately been obtained by Mr. Theobald at Nattung, on the Attaran river, near Moulmein.

It has quite the form of *Philippiana*, but is one third smaller, has one whorl less and the last whorl is comparatively a little more stretched. It appears to be a constant form and will probably deserve a separate specific name.

*Hab.* Common at the Farm-caves near Moulmein on limestone hills.

The animal of *Cl. Philippiana* is black with a greenish tinge on the posterior part of the body, which is covered with rather coarse warts; the pedicles are moderately elongated, pinkish, slightly swollen at the tips which bear the small eyes centrally; tentacles very short, but distinct; foot moderately elongated, strong, posteriorly obtusely pointed.

The clausilium is thin, white, somewhat broader than the expanded, and also white, portion of the columella, on which it reclines when the animal protrudes out of its shell. When closed, the external edge of the clausilium rest on the palatal folds; this appear to have the object of preventing the shell being closed hermetically, that is, to admit a little air even when the animal has retracted the body in the shell, which it can do far behind the clausilium.

The mantle has a free entire edge, and is internally somewhat thickened, especially on either side of the pulmonary orifice. At the place of the labial fold the edge is simply grooved. Corresponding to the columellar rib the groove is much stronger and deeper, extending with free raised edges to the mantle-margin. The lower (or anterior) of these lamellar edges is semicircularly enlarged, and towards the end folded over; it secretes the columellar fold, with its internal laminar projection for the support of the clausilium. The upper (or posterior) edge is smaller and evidently secretes the clausilium; it becomes folded over the former when the animal protrudes out of its shell.

As regards the internal structure there is nothing very distinct from the anatomy of the *HELICIDÆ*, as may be seen by a comparison of figure 8 on pl. vi, and the explanation accompanying it.

The pulmonary cavity is narrow and long, the mantle forming it being rather thick and of a deep pinkish black colour. The kidney is of a large sub-triangular form, and one portion of it almost entirely envelopes the heart. The mouth is small and the

salivary glands lie immediately behind it, covering the anterior part of the alimentary canal, while in most *HELICIDÆ*, they are on long peduncles and situated at the lower anterior base of the stomach. The oral parts and the salivary glands are pinkish grey. The intestines make only a slight bent and the rectum is accompanied by a very narrow albuminous gland, along which also the duct leading from the kidney appears to lay.

The retractor muscle of the body is divided in two very broad and strong parts; they are attached to the anterior end of the food, below the mouth, and divide posteriorly again into several thin branches. The retractor muscles, supporting the buccal parts, are shorter and also bipartite. The nervous ganglion ring lies immediately behind the mouth and is covered up by the anterior part of the salivary glands; it is very thin and gives only a few very thin branches to the lips, the pedicles and to the generative organs. The small extent of the nervous system is very striking, as compared with the same organs in the *HELICIDÆ* and *ZONITIDÆ*.

The generative organs fill the anterior part of the body nearly entirely. The uterus is comparatively thin, of grey colour; the albuminous gland (alg), attached to it, very large, nearly as long as the uterus, and more than double its thickness. The receptaculum seminis (rs) is an oval pedunculated gland, laying either along the uterus, or obliquely across the body, a short distance below the hermaphrodite opening, enveloped in soft tissue. It is provided with a long appendage, attached along the uterus, and equal in length to it. This appendage (ad) contains an orange coloured, tough flagellum, filled with a whitish substance, and possibly represents, the arrow (or amatorial) sac.

I have not observed the presence of spermatozoa in the so-called 'receptaculum seminis;' it was filled with flattened transparent bodies and some colouring matter. The vas deferens branches off about half way from the uterus, makes a few twists, attaches itself to the tissue just below the hermaphrodite opening, and then shortly after becomes thickened, being at this place fixed with a small and thin retractile muscle. The penis makes three distinct twists, or almost coils; it is very long and the terminal half is more thickened than the other; it ends with a thin flagellum.



The jaw is semilunar, narrow, thin, concentrically very finely, and radiately distantly and indistinctly, striated, the anterior concave edge is nearly perfectly entire.

The radula is long, moderately narrow, consisting of about 80 transverse, slightly angular series of teeth, there being 53 teeth in each series. The centre tooth is smaller than the adjoining, with a simple, inflected and pointed tip; it is contracted towards the base. The 14 inner laterals are longer and stronger than the 12 outer laterals. They are all tri-cusped; at first the median cusp is by far the largest, gradually, the lateral increase in size, while at the same time the median cusp decreases, until on the outermost lateral teeth the three cusps are almost equal. On the whole the form of the teeth agrees better with that of the *HELICIDÆ* than with the *ZONITIDÆ*. The dental formula is  $12 + 14 - 1 - 14 + 12$ .

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ON A QUANTITATIVE METHOD OF TESTING A "TELEGRAPH EARTH,"—  
by W. E. AYRTON, Esq.

[Received and read 6th April, 1871.]

The method that has been used up to the present time for testing a telegraph "earth" has been a qualitative method only, that is to say, although it may in a rough way have answered the question, is an "earth" good or bad, it was quite unable to give any answer to the question, how good or how bad.

In Europe the ordinary way to make an "earth" is to use the iron gas, or water pipes, but in most places in India such pipes do not exist, so that some large piece of metal has to be buried for this purpose. A coil of iron wire, a piece of an iron post, or a copper plate have been used at different times. Now as the nature of the ground in the immediate neighbourhood of this buried piece of metal greatly affects its electrical utility, it becomes a question of great practical importance to determine in absolute units the resistance of the "earth" used in each particular case.

The following method devised by Mr. Schwendler is at present in use in the Indian Telegraph Department.

Select two other earths which are neither in metallic connection with each other nor with the telegraph earth to be tested. Two iron telegraph posts near the office answer the purpose very well, only care must be taken that there is perfect metallic contact between the leading wire and the iron post in each case. In the dry season it would be advisable to pour water over the three "earths" used. Measure the resistance between each set of "earths," and in this way obtain three independent equations containing the three resistances of the three "earths," and the known resistances of the three leading wires going respectively from each "earth" to the testing arrangement. For instance calling  $x$  the resistance of the "earth" to be measured, that is, the resistance between the copper plate or iron wire (or whatever the "earth" consists of) and the ground, and  $a$  the known resistance of the wire leading from this "earth" to the testing arrangement,  $y$  and  $z$  the resistances of the other two earths, and  $\beta$  and  $\gamma$  the resistances of their leading wires we have—

$$x + y + a + \beta = r_1$$

$$y + z + \beta + \gamma = r_2$$

$$z + x + \gamma + a = r_3$$

From these three equations, eliminating  $y$  and  $z$ , we obtain

$$x = \frac{r_1 - r_2 + r_3}{2} - a \dots \dots \dots (I)$$

And the question would be completely solved, if earth circuits did actually behave as simple metallic circuits. This is, however, not the case. For in the first place an "earth" long used for telegraphic purposes frequently acquires a highly polarized state, giving rise to a current. Secondly if the "earths" used are not of the same material, for instance one an iron post and the other a copper plate, they will form a galvanic element with the ground giving rise to a current. Thirdly a real earth current may exist from terrestrial causes, and lastly the testing current itself polarizes the "earths." Consequently the measurement of the same set of earths taken successively with positive and negative currents will not agree, and they will differ from each other much, if the current, due to the "earths," is large in comparison with the testing current itself. It, therefore, becomes necessary to devise some method by which trustworthy tests may be made, and to see how

from the tests the real resistances of the "earths" may be arrived at.

Before and after each set of tests note the whole, or a definite portion, of the current caused by the two earths under measurement, by simply joining the two earths together through a galvanometer and observing the deflection. If this deflection is practically the same before and after the two tests with reverse currents, the "earths" have not altered their electrical condition while being tested, and the two values obtained may be used for further calculation. In order to keep the electrical condition of the "earths" constant, by preventing them becoming polarised by the testing current, it is necessary to measure with only momentary currents.

The formula which gives the actual value of the resistance of a pair of earths from the two values obtained by testing with positive and negative currents depends, of course, on the kind of testing arrangement employed. For a Wheatstone's balance the formula is

$$r = \frac{BF(A+B)(W'+W'') + B^2\{A(W'+W'') + 2W'W''\}}{AB(W'+W'') + 2AF(A+B) + 2A^2B} \quad (\text{II})^*$$

where A and B represent the branch resistances in the bridge, A the resistance opposite to r the resistance to be measured, F the resistance of the testing battery, and W' and W'' the resistances unplugged respectively in the comparison coil to obtain balance when testing with reverse currents. Putting A equal to B, or testing with equal branches we have

$$r = \frac{(2F+A)(W'+W'') + 2W'W''}{W'+W'' + 2(2F+A)} \dots\dots\dots (\text{III})$$

If W' and W'' are very nearly equal, or small compared with A and F we have

$$r = \frac{W' + W''}{2} \quad \dagger$$

If the instrument used be a differential galvanometer in which the two coils have equal resistance, but opposite magnetic momentum, then

$$r = \frac{(2F+G)(W'+W'') + 2W'W''}{W'+W'' + 2(2F+G)} \dots\dots\dots (\text{IV})\ddagger$$

* (See Appendix I, p. 181).

† (See Appendix II, p. 182).

‡ (See Appendix III, p. 183).

where  $G$  stands for the resistance of one of the coils of the galvanometer.

By formulæ (II) (III) or (IV) the resistances respectively between each set of earths can be correctly calculated, and these values being substituted for  $r_1$ ,  $r_2$  and  $r_3$  in formula (I), we can find  $x$  the required resistance of the earth.

When a Wheatstone's bridge or differential galvanometer are not available the required resistance of the "earth" may be obtained in the following way by comparative deflections. For simplicity two leading wires only need be used, one just long enough to reach to the most distant "earth" of the three, and the other just long enough to reach the next distant.

Make the five following observations of deflections with the galvanometer, the same battery being used in all cases, and each test made with positive and negative currents and the mean taken.

I. When the galvanometer alone is in circuit : deflection =  $a^\circ$ .

II. When the two leading wires, and the galvanometer are in circuit : deflection =  $b^\circ$ .

III. When the Telegraph earth, one of the new earths, the two leading wires, and the galvanometer are in circuit : deflection =  $c^\circ$ .

IV. When the Telegraph earth, the other new earth, the two leading wires and the galvanometer are in circuit : deflection =  $d^\circ$ .

V. When the two new earths, the two leading wires, and the galvanometer are in circuit : deflection =  $e^\circ$ .

Then if the deflections are small, so that they are proportional to the currents, we have

$$x = \frac{G + F}{2} \left( \frac{a}{c} + \frac{a}{d} - \frac{a}{b} - \frac{a}{e} \right)^*$$

where  $x$  is the required resistance of the "earth"  $G$  and  $F$  the known resistances of the galvanometer and battery respectively.

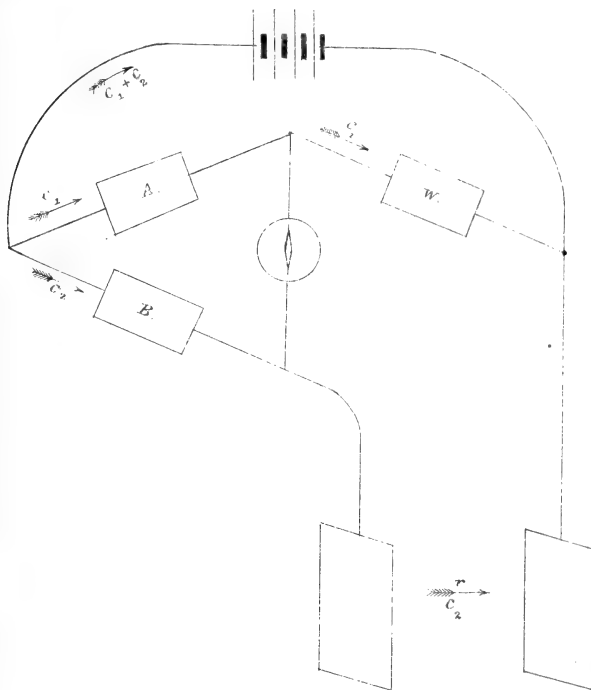
If the deflections be large and the galvanometer used by a sine or tangent galvanometer, then the sines or tangents respectively of the deflections must be substituted in the above formula instead of the simple deflections themselves.

* (See Appendix IV, p. 183).

## (Appendix I.)

Equation (II) is necessarily precisely similar to that given by Mr. Schwendler in his "testing instructions" for finding the resistance of a line when a natural current exists in it; but as the proof, for brevity's sake, has been omitted there, I have given it as follows in its simplest form.

In the following figure, when balance is established, that is, when no current goes through the galvanometer, we have, by Kirchhoff's equations, when the earth current tends to help the testing current.



$$\left. \begin{array}{l} C_1 A - C_2 B = 0 \\ C_2 r - C_1 W = e \\ (C_1 + C_2) F + C_2 (B + r) = E + e \end{array} \right\} \dots\dots\dots \text{(VIII)}$$

where  $E$  is the electromotive force of the testing battery, and  $e$  that of the earth current.

If the testing battery be reversed so that the earth current tends to oppose the testing current we have—

$$\left. \begin{aligned} C'_1 A - C'_2 B &= 0 \\ C'_1 W'' - C'_2 r &= e \\ (C'_1 + C'_2) F + C'_2 (B + r) &= E - e \end{aligned} \right\} \dots\dots\dots (IX)$$

From equations (VIII) by eliminating  $C_2$  we obtain.

$$\frac{C_1 \frac{A}{B} r - C_1 W'}{\left( C_1 + C_1 \frac{A}{B} \right) F + C_1 \frac{A}{B} (B + r)} = \frac{e}{E + e}.$$

$$\text{or } \frac{\frac{A}{B} r - W'}{\left( 1 + \frac{A}{B} \right) F + \frac{A}{B} (B + r)} = \frac{1}{\frac{E}{e} + 1} \dots\dots\dots (X)$$

Similarly from equations (IX) we obtain—

$$\frac{W'' - \frac{A}{B} r}{\left( 1 + \frac{A}{B} \right) F + \frac{A}{B} (B + r)} = \frac{1}{\frac{E}{e} - 1} \dots\dots\dots (XI)$$

Eliminating  $\frac{E}{e}$  from equations (X) and (XI) we obtain.

$$r = \frac{BF(A + B)(W' + W'') + B^2 \{ A(W' + W'') + 2W'W'' \}}{AB(W' + W'') + 2AF(A + B) + 2A^2B}$$

#### (Appendix II.)

First let  $W'$  and  $W''$  be very nearly equal, that is,

$$\text{let } W'' = W' + dW'$$

$$\text{then } 2W'W'' = 2W'(W' + dW')$$

$$= W'^2 + (W' + dW')^2 - \overline{dW'}^2$$

$$\therefore 2W'W'' = (W' + W'')^2 - 2W'W'' - \overline{dW'}^2$$

$$\text{or } 2W'W'' = \frac{(W' + W'')^2}{2}$$

in which the square of a differential only is neglected. Substituting this value for  $2W'W''$  in equation (III) we obtain :

$$r = \frac{\frac{2(2F+A)(W'+W'')}{2} + \frac{(W'+W'')^2}{2}}{2(2F+A) + W' + W''}$$

$$\therefore r = \frac{W' + W''}{2}.$$

Secondly let  $W'$  and  $W''$  be both small compared with  $A$  and  $F$ , but  $W'$  and  $W''$  not necessarily equal to one another, then

$$r = \frac{(2F+A)(W'+W'')}{2(2F+A)} \text{ approximately,}$$

$$\therefore r = \frac{W' + W''}{2} \text{ approximately.}$$

(Appendix III.)

Equation (IV) can be obtained directly from equation (III) by substituting  $G$  for  $A$ , and this is precisely what would be anticipated since the law for a differential galvanometer, when the currents balance one another, must be precisely the same as that for a Wheatstone's Bridge at balance with equal branches; the two branches of the Bridge corresponding respectively with the coils of the differential galvanometer.

(Appendix IV.)

If  $x, y, z$ , be the resistances of the three "earths" used, and  $a$  and  $\beta$  the resistances of the two leading wires then.

$$a^\circ = \frac{M}{G+F} \left\{ \begin{array}{l} \text{where } M \text{ is a constant depending on the} \\ \text{battery power employed, and the deli-} \\ \text{cacy of the galvanometer.} \end{array} \right.$$

$$b^\circ = \frac{M}{G+F+\alpha+\beta}$$

$$c^\circ = \frac{M}{G+F+x+y+\alpha+\beta}$$

$$d^\circ = \frac{M}{G+F+x+z+\alpha+\beta}$$

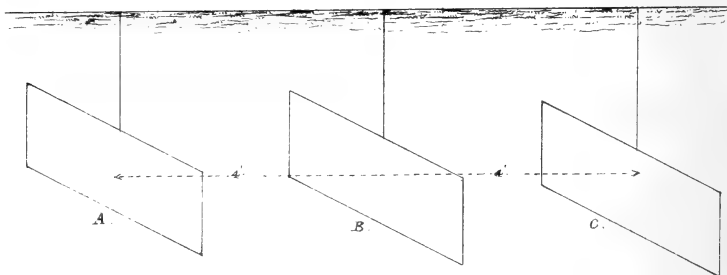
$$e^\circ = \frac{M}{G+F+y+z+\alpha+\beta}.$$

Eliminating  $y$ ,  $z$ ,  $(a + \beta)$ , and  $M$  from the preceding five equations we obtain—

$$x = \frac{G + F}{2} \left( \frac{a}{c} + \frac{a}{d} - \frac{a}{b} - \frac{a}{e} \right).$$

As an illustration of the method described in this paper I made the following experiments with three earth plates, each 2 feet by 4, and using a Wheatstone's Bridge as my testing arrangement.

*Experiment 1.* The plates were buried vertically and parallel to one another with the longer edges horizontal and so that the line joining the centres of the plates was perpendicular to each plate. The centres were 4 feet apart, and 2 feet 6 inches below the surface of the ground.



The resistances of the circuit from plate A through the ground to plate C was very little more than that of the circuit from plate A through the ground to plate B although C was twice as far from A as B was, thus showing that in earth circuits the resistance is not so much in the earth itself, but exists between the surface of the metal plate and the earth. Using in the way previously explained in this paper the values I obtained I found that—

Resistance of plate A = 8.49 Siemens Units.

„ „ B = 5.86 „ „

„ „ C = 10.23 „ „

*Experiment 2.* The plates A and C remained as before, but B was placed horizontally, its centre being still 2 feet 6 inches below



the surface of the ground, and 4 feet from the centres of A and B.

Resistance of plate A = 8.95 S. U

„ „ B = 6.2 „ „

„ „ C = 11.77 „ „

The values are somewhat higher than those previously obtained, but this I think is due to the ground being drier than before.

*Experiment 3.* Plates A and B remained as before, but B was placed horizontally, with its centre only 6 inches below the surface.

Resistance of plate A = 9.44 S. U

„ „ B = 17.49 „ „

„ „ C = 11.92 „ „

so that the resistance of B is nearly three times as great as it was before.

*Experiment 4.* All the plates in the same position as in the last experiment, but B was well surrounded with a layer of charcoal.

Resistance of plate A = 9.39 S. U

„ „ B = 17.04 „ „

„ „ C = 11.99 „ „

these results are very nearly the same as those obtained in experiment 3.

As a general rule, it may be said, that the lower an earth plate is buried the less is its resistance, or the better is it for telegraphic purposes. This rule, however, must be used with caution, because it assumes that the ground is of the same conducting quality at the different depths.

For example at the Jubbulpore office in order to obtain a good "earth" a large copper earth plate 5 feet square was buried vertically 17 feet deep. On my passing through Jubbulpore I tested this earth plate and found that it had a resistance of 50 S. U. On having the plate dug up I found that the high resistance was due to the plate having been buried in solid sandstone. I afterwards had the plate buried horizontally in the upper stratum of the soil and well surrounded with charcoal, and now the resistance was only 20 S. U, or less than one half of what it was before.

At Raneegunge Mr. Schwendler found that the earth plate there never had more than 0.5 S. U resistance. This very low resistance was probably due to the coal which exists there from 2 to 4 feet below the surface and in some places is actually exposed.

ON A NEW SPECIES OF VESPERTILIO, *by* G. E. DOBSON, B. A., M. B.,  
*Assistant Surgeon, H. M.'s British Forces.*

[Received 1st March, 1871.]

For a period of ten years, the history of the Indian *Cheiroptera* has been in abeyance. In the beginning of 1861, Mr. Blyth published his last remarks on some new species of this order in the Proceedings of the Asiatic Society, and so brought to a close his contributions to our knowledge of this very interesting order of Mammals, an order which he enlarged by the addition, not only of several new species but also a new genus, recording also in the Journal of the Society his original observations on the habits of some individuals.* In Dr. Jerdon's 'Mammals of India' published in 1867, the order is systematically treated of, but no species not included in Blyth's catalogue are described. In Europe during the past ten years the progress of knowledge in this direction has not been great, and the *Cheiroptera* have in common with other orders of the higher classes of animals shared equal neglect, since naturalists began to examine into final causes, and in the study of developmental theories confined the greater portion of their attention to the extreme limits of the zoological series — to Monkeys and Monads.

I have, therefore, much satisfaction in bringing to the notice of zoologists a new species of Insectivorous_bats.

**Vespertilio auratus.**† Pl. x, figs. 1—2.

Top of the head very slightly elevated, thickly covered with woolly hair which extends forwards upon the face, forming a fringe

* His paper on the blood-thirsty propensities of some individuals of the genus "*Megaderma*" will well repay perusal. See J. A. S. Beng., vol. xi.

† In the abstract of this paper in the Proceedings Asiatic Society for March, 1871, this species was referred to as *Kerivoula aurata*, but taking Tomes' and Peters's view of classification, I believe, that *Kerivoula* can be regarded only as a sub-genus of *Vespertilio*. A figure of the head and ear of the species will be published in the next number of the Journal.

In the same number of the Proceedings I have made reference to a peculiar *Murina* like bat which I believed to belong to a new genus, for which I proposed

along the margin of the upper lip, almost concealing the minute eyes, and leaving the tip of the nose alone uncovered.

Ears ovate, with obtusely pointed tips directed outwards; outer margin concave immediately beneath the tip, becoming gradually convex and forming a small lobe near the base: tragus long, narrow, and obtusely pointed; inner margin straight, outer margin curved outwards at the base for about one-third its length, then ascending straight, equally inclined to the inner margin; on the curve near the base a very small lobulus is placed, which is not succeeded by an emargination. Nose projecting slightly beyond upper lip, with a very shallow emargination between the nostrils which open sublaterally.

Thumb rather long, basal phalanx less than half its length; foot moderately large, toes more than half its length. Wing membrane very broad, attached close to base of outer toe, beautifully variegated with orange and brown-black. The portions of dark coloured membrane are triangular in form, and occupy the spaces between the second and third, and third and fourth fingers, and also the space included between the fourth finger and a line drawn from the carpus to the angle. All the remaining portions of membrane, including the ears and interfemoral membrane, are orange. The orange colour extends in narrow lines along the fingers, the bones of which are of the same hue, and is dispersed over the dark triangular spaces in dots and streaks.

The fur of the back is everywhere thick and woolly, tricoloured, dusky at the base for about one-third its length, then light fawn colour, the ends of the hairs tipped with light golden brown; beneath light fawn colour, the hairs paler at the base.

Above, the fur of the back extends upon the humerus and ante-humeral membrane for half their length, on the wing membranes it occupies but a very small space, about 0".3 wide, termi-

the name *Stenopterus*. I have since examined several specimens of *Murina swilla* from the same locality, and it appears to me very probable that the narrowness of the wing in the so-called *Stenopterus*, and the smaller number of phalanges, has to be attributed to an accidental abnormality in a specimen of the above noticed *Murina*. I, therefore, defer characterizing that specimen until I may be enabled to trace its exact relation to *Murina*. The name *Stenopterus*, having been already used in other branches of Zoology, cannot again be employed in this case.

nating rather abruptly; behind, it passes on to the inter-femoral membrane covering nearly half its surface and, leaving the posterior half of the interfemoral membrane, the calcanea and metatarsi bare, reappears on the back of the toes.

Beneath, the fur of the thorax extends along the humerus to the elbow joint, and as far as a line drawn from the elbow to the knee joint the wing membrane is covered with a few scattered hairs; behind, the fur of the abdomen extends backwards upon the inter-femoral membrane, rather densely at the root of the tail, but quickly thinning out into a few, very short, scattered hairs which extend over half its surface. The back of the ear is naked except at the base, in front it is clothed with a few short hairs.

Dentition. In.  $\frac{2-2}{6}$ ; p. m.  $\frac{2-2}{3-3}$ ; m.  $\frac{3-3}{3-3}$ .

Length, head and body, .....	2·4 inches.
„ tail, .....	1·9 „
„ head, .....	0·8 „
Height of ear, .....	0·6 „
Breadth „ .....	0·35 „
Length of tragus, .....	0·35 „
Breadth „ (greatest), .....	0·07 „
Length of forearm, .....	1·9 „
„ 2nd finger, .....	3·3 „
„ 4th „ .....	2·7 „
„ thumb, .....	0·45 „
„ tibia, .....	0·9 „
„ foot and claws, .....	0·4 „
„ calcaneum, .....	0·8 „
Expanse, .....	12·6 „

On first examining the specimen, from which the foregoing description is obtained, I was inclined to believe it might be referred to either *V. formosus* (Hodgs.), or *V. rufo-pictus* (Waterh.), but a more careful comparison with the descriptions of these species given by Mr. Tomes in the Ann. and Mag. Nat. Hist. rendered it evident that it differs, not only in dentition, but also in several other important characters, as the form of the tragus, the position of the emargination on the outer edge of the ear, the distribution and colour of the fur, &c.

*Loc.* Darjeeling.

CONTRIBUTIONS TO INDIAN CARCINOLOGY.—ON INDIAN AND MALAYAN  
TELPHUSIDÆ, PART I,—by JAMES WOOD-MASON of *Queen's College,  
Oxford.*

(With Plates XI and XII.)

[Read 5th April, received 25th April, 1871.]

In the year 1869,* M. Alphonse Milne-Edwards published a Revision of the genus *Telphusa* with descriptions of some new forms which brought up the number of known species to thirty-six.

In 1868,† E. von Martens (in a paper entitled "*Ueber einige Ost-asiatische Süßwasserthiere*") described *T. Borneensis* from the rivers of Borneo.

In this, the first part of my paper on the TELPHUSIDÆ, which will be continued in succeeding numbers of the Journal, I shall give descriptions of fifteen new species; of which two belong to Milne-Edwards' sub-genus *Paratelphusa*.

For the opportunity of drawing up these descriptions, I am especially indebted to my friend, Dr. F. Stoliczka, who has also added to the Museum collections under my care many interesting species of marine Crustacea; to Dr. Francis Day; to my colleague Dr. J. Anderson who collected several species during the Yunan expedition; to Major Godwin-Austen and to Captain Stewart-Pratt of Morar; to Messrs. W. T. Blanford, V. Ball, H. L. Houghton and above all to that indefatigable observer Mr. S. E. Peal of Sibsaugur who has so greatly enriched the collections of the Indian Museum in every group of the Arthropoda.

The TELPHUSIDÆ are essentially fresh-water Crustaceans, but in India are commonly called land-crabs from the circumstance that many of the species are able to live for a very considerable time out of water, far removed from rivers, tanks, marshes, jhils, &c., provided that the air that enters the branchial chamber is sufficiently saturated with moisture to prevent the branchiæ from becoming desiccated, and so unfitted for the performance of their respiratory functions. My freind, Captain Stewart Pratt, forwarded to me, at the commencement of the present hot season, specimens of *Telphusa*

* Nouvelles arch. du Mus., 1869, tom. V, p. 161—191, pl. 8—11.

† Wiegmann's Archiv für Naturg., xxxiv, Jahrg., 1 Bd., p. 18.

*Indica* which he had obtained from holes dug by the crabs in the neighbourhood of water; the bottoms of these holes were found to be below the level of the neighbouring water, and there appears to be good reason for believing that these creatures deepen their holes *pari passu* with the change in the level of the water, so that moisture sufficient for the maintenance of their branchiæ in a state fit for respiration may reach their retreats. Col. Sykes' account* of the so-called land-crabs of the Dekhan, prefixed to Prof. Westwood's description of *Telphusa cunicularis* = *Indica*, Latr., gives a good idea of the terrestrial habits, the prodigious numbers, and the extent of the burrowings of these creatures.

Stimpson,† influenced by the feeble development of the post-frontal crest and by the absence of the epibranchial teeth in certain species, but especially by their terrestrial habits, gave them the generic appellation of *Geotelphusa*. But, as M. Alphonse Milne-Edwards justly remarks, there appear to be no sufficient reasons for the foundation of this new genus, the definition of the limits of such an artificial group being difficult, because there are species possessing all the essential characters of *Telphusa*, in which the frontal crests become more and more obliterated and the epibranchial teeth scarcely perceptible.

The land-crabs, properly so-called, belong to the GECARCINIDÆ, a family of the CRUSTACEA GRAPSOIDEA of Dana (= CATOMETOPA, M. Edw., minus TELPHUSIENS), and are well known from the accounts of the extraordinary periodical migrations of the species of the West Indian genus *Gecarcinus* to the sea for the purpose of depositing their eggs or brood. This family is represented in India by *Cardisoma* which is widely distributed, and by *Gecarcinuca Jacquemontii*, M.—Edw., occurring in great numbers in company with *Telphusa Guerini*, M.—Edw., at Khandalla in the Western Ghâts.

Dana in his great work on the Crustacea, acknowledging the greater affinities of TELPHUSIDÆ to the CANCROIDEA, to which they are united by such forms as *Eriphia*, removed them from their

* Trans. Entom. Soc. Lond. vol. i, p. 181.

† Proc. Acad. Nat. Sc. Phil. 1858, p. 179.

association with the GRAPSIDÆ in the CATOMETOPA, and placed them in their more natural position next to the CANCROIDEA TYPICA under the legionary name of the TELPHUSINEA or CANCROIDEA GRAPSIDICA, on the ground that they possess the same number of branchiæ, a similar abdomen, and have the male copulatory organs similarly inserted in the basilar joint of the last pair of ambulatory legs, and covered from their origin by the abdomen. The TELPHUSIDÆ, however, evidently constitute a transition between the CANCROIDEA TYPICA and the GRAPSOIDEA, as may be seen from their general Grapsoid form.

The family TELPHUSIDÆ is divisible into the following genera and subgenera:—

TELPHUSA, (Syn. *Geotelphusa*): *Hab.* Southern Europe, Africa, India and its islands, Burma, China, Australia, Chili.

PARATELPHUSA: *Hab.* South-Eastern Bengal, Assam, Burma, Pegu, China, Siam and the Indo-Malayan Archipelago.

BOSCIA, DILOCARCINUS, SYLVIOCARCINUS, POTAMOCARCINUS, TRICHODACTYLUS, &c.: *Hab.* Tropical America.

DECKENIA: *Hab.* Eastern Africa (Zanzibar). This genus resembles the TELPHUSIDÆ in the development of the branchial regions and in the position of the male copulatory organs, but the structure of the external maxillipedes and position of the efferent orifices of the branchial cavities recalls the disposition of these parts in the Oxystomatous Crustacea.

Of the developmental history of the TELPHUSIDÆ nothing is, I believe, known, and I extremely regret that I have not yet had an opportunity of making observations on this head; but this I can say, that the ova are of large size and few in number. Whether, however, direct development without metamorphosis is correlated with the large size of the eggs and their fewness in number, as in the single instance amongst the Brachyura (in *Gecarcinus*), investigated by Prof. Westwood, or whether the young commence their existence as Zoëas, as in another species of the same genus, noted by Thomson, must be left for future observations. Arguing from what happens in the case of fresh-water branchiferous Gasteropods,* the

* Troschel, Hand. der Zoologie.

young of which possess no ciliated buccal lobes, while these are possessed by the allied LITTORINIDÆ, and from other instances in which fresh-water allies of marine animals, which do undergo a metamorphosis, are ametabolous, it is probable that the young of the TELPHUSIDÆ leave the egg in a condition differing but little from that of their parents.

## CRUSTACEA CANCROIDEA.

### TELPHUSINEA VEL CANCROIDEA GRAFSIDICA.

#### Fam.—TELPHUSIDÆ.

#### Genus.—TELPHUSA, Latreille.

*Diagnosis*.—Carapace broader than long, with the interregional furrows little marked, with the exception of the cervical suture which is occasionally very deeply impressed. Front deflexed, generally with a straight free margin; orbits large with their infero-internal angle sending upwards a stout vertical tooth to about against the antennæ, which are exceedingly small and lodged in the inner canthus of the eye. Antennular pits pretty long, but very narrow. External maxillipedes large with their third joint subquadrate, with the antero-internal angle truncated and giving insertion to the fourth joint. Sternal region almost as long as broad. Abdomen of both males and females constituted by 7 free somites.

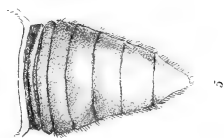
#### Sub-genus.—PARATELPHUSA, M.-Edw.

The species referable to the subgenus *Paratelphusa* are further characterized by the presence of an acute spine on the superior angle of the meropodites of the chelipedes, situated just behind the constriction near the distal articular end of the joint; the inferior angles of the joint being rounded off, and devoid of the tubercles which are invariably present in *Telphusa*.

#### *Paratelphusa* Dayana, n. sp. Pl. XI.

The carapace is much broader than long, the greatest breadth being measured between the points of the last epibranchial tooth, extremely convex, smooth, punctate, and appears finely granular under an ordinary lens. The branchial lobes are greatly swollen and are not sub-divided into anterior and posterior divisions; the mesial crescentic portion of the cervical suture is distinctly marked

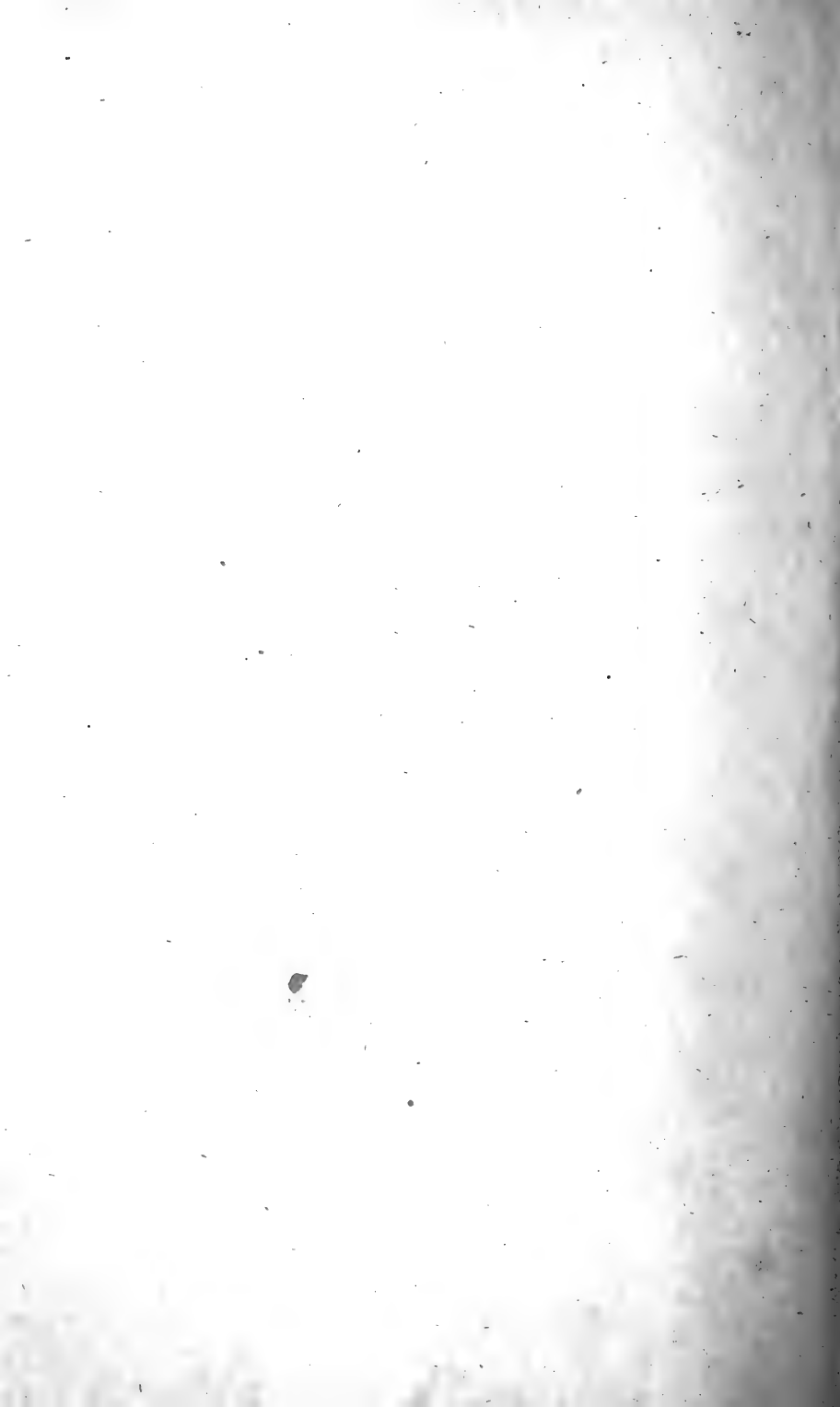


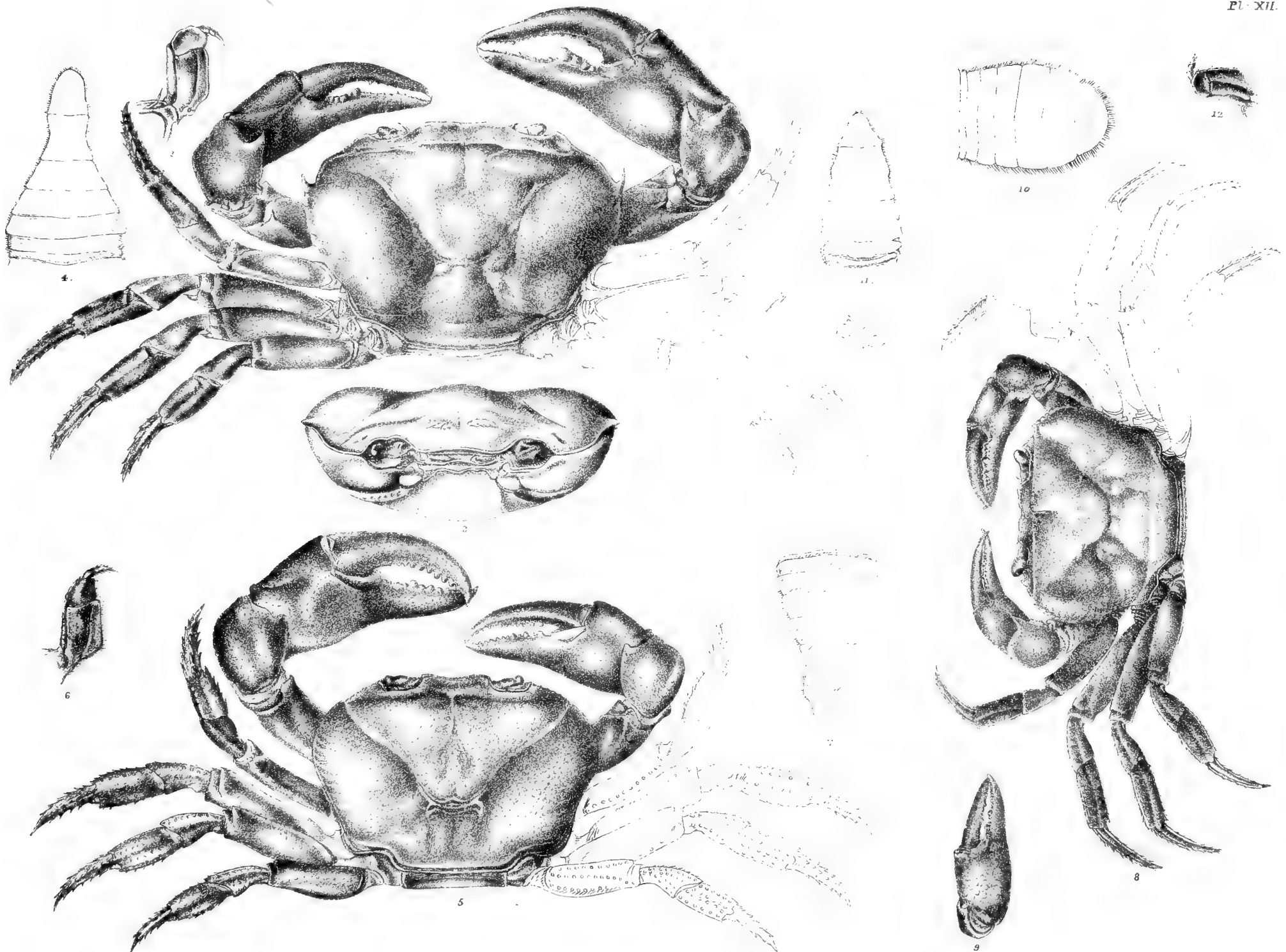


S. Sedgfield. Lith.

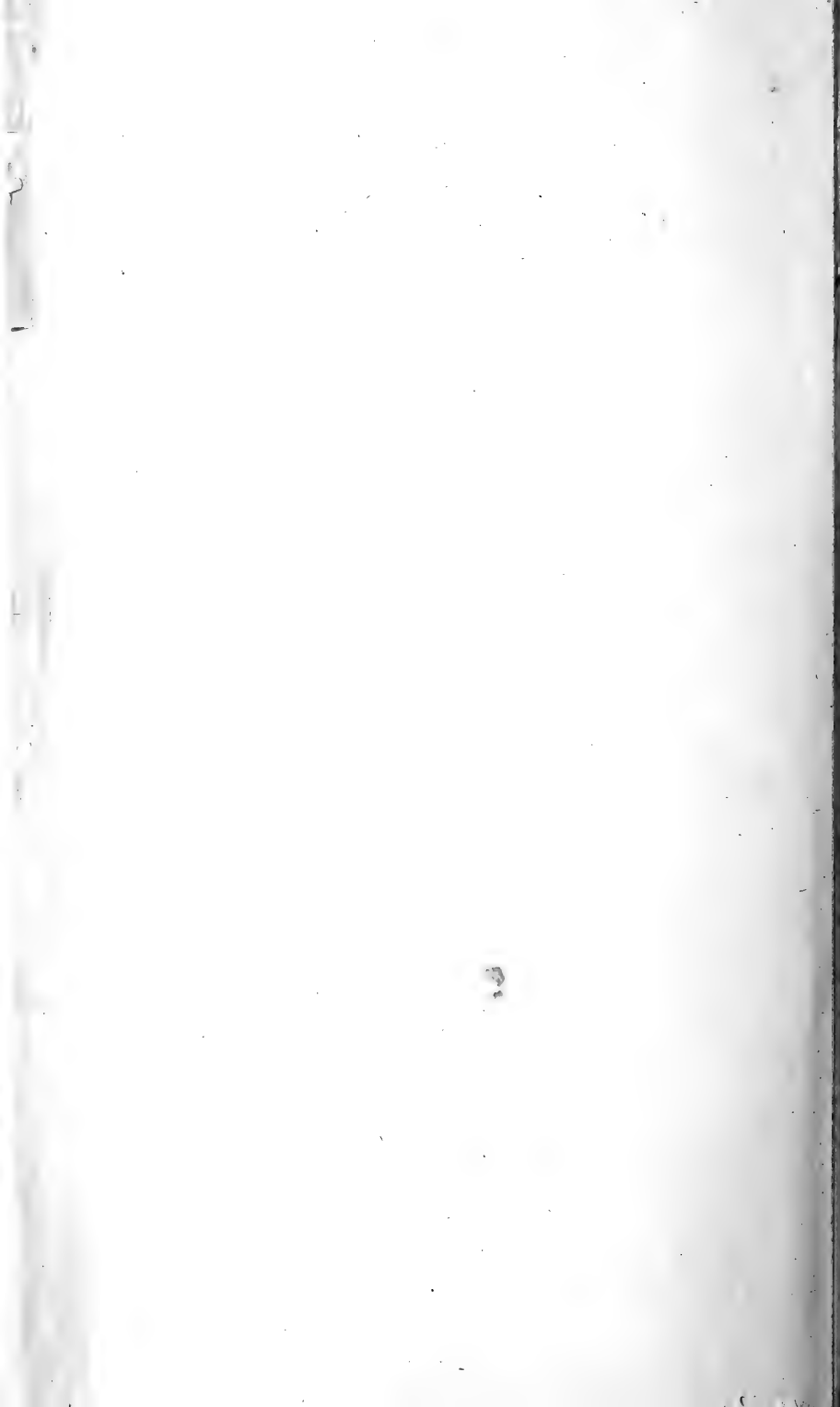
*Paratelphusa Dayana*, n. sp.

*Calcutta*





1-4. *Paratelphusa spinigera*, p. 194. 5-7. *Telphusa lugubris*, p. 197. 8-12. *Telphusa stoliczkae*, p. 199.



and continued nearly to the level of the last epibranchial tooth, where it ends to appear again opposite the second tooth, whence it passes to the edge of the post-frontal crest which it but faintly indents. The post-frontal ridge is well marked and, between the point at which its edge is notched by the passage across it of the cervical suture and the anterior epibranchial tooth, is crenulated; the cardiac lobe is marked off from the branchial by two shallow almost linear depressions on each side of the middle line, and in front from the urogastric by a line curving almost concentrically with the convexity of the cervical suture. The epigastric lobes are slightly wrinkled or foveate anteriorly, and advanced beyond the line of the post-frontal crest as in *Paratelphusa spinigera*, and separated from one another by the mesogastric suture, which rapidly bifurcates as it passes backwards, appearing as a short V-shaped impression on the carapace, the space intercepted between the arms of the V being the point of the narrow anterior prolongation of the mesogastric lobe.

The antero-lateral margins are inclined and armed, not counting the blunt extra-orbital tooth with its curved external margin, each with four acute, spiniform epibranchial teeth of which the most anterior is the largest; the rest are equal in size to, and equidistant from each other; from the last a short well defined keel, obscurely crenated on its inner edge, passes backwards and inwards on to the carapace which is marked with a few small straggling tubercles along the line of the epibranchial spines. Front very broad especially at base, punctate, finely granular and transversely wrinkled, its free margin is bayed in the middle line, but not greatly lamellar and projecting forwards over the epistomial region, as in *Paratelphusa sinensis*, M.-Edw., and in *P. spinigera*.

The inflected portion of the carapace is finely tuberculated anteriorly; anterior pleural lobe distinct and almost devoid of tubercles; posterior pleural smooth, thickly granulated where it bounds the anterior pleural.

The anterior boundary of the epistoma is crenulated; its posterior margin is notched on each side of the middle line from which a long sharp process extends downwards between the palpiform appendages of the external maxillipedes; this process does not

correspond exactly with the triangular process of the epistoma in other species of *Telphusa*, but is the greatly developed median palatal ridge; externally to each notch the posterior margin of the epistoma forms two distinct lobes with granulated edges. The second joint of the external maxillipedes is punctate and its external margin crenulated. The third joint is much broader than long and has its external and anterior angles well rounded off and distinctly granular; the exopodite is crenulated on its internal margin. The abdomen of the male differs greatly from that of *Paratelphusa spinigera*, having the form of an isosceles triangle.

The chelipedes are greatly unequal in size, both in males and females, especially in the former; the meropodites have their ventral angles rounded off as in *Paratelphusa spinigera*, their outer or posterior face rugose, their posterior angle also rugose and armed with a sharp spine arising just proximally to the constriction near the distal articular end; carpopodites faintly rugose above, armed with a single excessively long, stout spine; penultimate joint obsoletely tubercular above, externally and internally all but smooth; in the larger claw a considerable hiatus exists between the dentated margin of the prolongation of this joint and that of the dactylopodite, which in the smaller claw is throughout its length in complete contact with the immoveable arm of the pincers.

The terminal joints of the ambulatory legs are extremely slender, acute, and armed with fine sharp spines.

Breadth, ..... 42 mm.

Length, ..... 31 mm.

*Hab.* Mandélé and Prome, Upper Burma.

Plate XI. Fig. 1. *Paratelphusa Dayana*, of the natural size; 2. Front view. 3. External view of right chela. 4. External maxillipede. 5. Abdomen of the male. 6. The same of a female.

#### PARATELPHUSA SPINIGERA, Pl. XII, Figs. 1-4.

'*Telphusa spinigera*,' White, MSS. List of the specimens of Crustacea in the collection of the British Museum, p. 30, (no description).

Carapace very greatly broader than long, smooth except on the postero-lateral margin which bears numerous wrinkles; these are con-

tinued neither on to the inflected portion of the carapace, nor on the posterior pleural region; front broad, punctate, projecting pent-house fashion over the antennular pits between which it wholly forms the broad septum; its free margin is sinuous, presenting mesially a broad shallow bay; orbital borders indistinctly crenulated; the anterior pleural or subhepatic regions are faintly marked off from the inflected portion of the carapace which bounds them externally, while they are most distinctly separated from those portions of the posterior pleural lobes which pass forwards, so as to form the parallel boundaries of the buccal frame by a deep groove, running outwards and backwards from the epistoma; this is deeply excavated and its posterior margin sends backwards in the middle line a short broad-based triangular projection. The extra-orbital angle is somewhat obtuse and is widely separated from the single acute forwardly directed epibranchial spine, in the rear of which is a very short smooth crest. Branchial lobes enormously swollen and not subdivided, separated from the gastric region by the deeply impressed cervical suture which does not pass through the postfrontal crest; this subsides without reaching the acute, arched antero-lateral margin, and is interrupted by the advanced position of the epigastric lobes; these are in front rugose and faintly distinguishable from the rest of the gastric region, but separated from one another by a short mesogastric furrow. A very deep muscular impression is visible at each postero-lateral angle of the gastric area. Cardiac region convex, distinct. Two large puncta, which frequently become confluent, mark the post-frontal furrow behind the external canthus of the eye. Chelipedes smooth and extremely unequal both in males and females, in some the right, in others the left being the larger; meropodites are smooth and their angles rounded, the upper one only being slightly rugose and bearing proximally to the constriction at its distal extremity a sharp spine, as in the rest of the species of the subgenus. The upper surfaces of the carpopodites are transversely convex; their inner margins armed with an exceedingly stout sharp spine; the penultimate joint is internally smooth, convex and punctate, the puncta being disposed in longitudinal series; the dactylopodites are slender, much curved, longitudinally punctate, minutely granular and only in contact with the extremity of the produced

portion of the preceding joint in adult individuals. The ambulatory legs and the dorsal edges of their meropodites are perfectly smooth.

Breadth, .. ..... 58 mm.

Length, ..... 40 mm.

*Hab.* I found this interesting species exceedingly abundant in the tanks of Calcutta. It has recently been collected by my servant, who accompanied Dr. Day on a trip to the upper waters of the Ganges, at Hurdwar and at Roorkee, where it lives in the river itself and in the contiguous ponds and marshes.

Plate XII. Fig. 1. *Paratelphusa spinigera* of the natural size. 2. Front view. 3. External maxillipede. 4. Abdomen of the male.

#### TELPHUSA INDICA.

*Telphusa Indica*, Latreille, Encyclo. Méth., Insectes, t. X, p. 563;—Guérin-Méneville, Iconographie du Règne animal, Crust., pl. iii, fig. 3;—Milne-Edwards, Hist. Nat. des Crust., t. II, p. 13; and Voy. de M. Jacquemont dans l'Inde, p. 7, pl. ii, fig. 1—4;—Alph. Milne-Edwards, Révision du genre *Thelphusa* et description de quelques espèces nouvelles.

*Thelphusa cunicularis*, Westwood, Trans. Entom. Soc., London, vol. i, p. 183, pl. xix, fig. 1—6.

The largest specimen in my possession measures in a straight line in breadth 83 mm., in length 59 mm., and was collected with two others at Singhur near Poona in running water. It was in this neighbourhood also that M. Jacquemont collected his specimens. Col. Sykes, in his account of the land-crabs of the Dekhan, prefixed to Prof. Westwood's description of the species under the name of *Thelphusa cunicularis*, mentions its occurrence in the same place, and in all the valleys and on the most elevated tablelands of the Ghâts at from 2,000 to 5,000 feet above the sea-level, and is of opinion that it does not extend more than fifteen or twenty miles to the eastward of the Ghâts. Mr. W. T. Blanford has, however, brought specimens from S. E. Berar, west of Chanda, and I am indebted to Mr. V. Ball for examples from near Chota Nagpúr. One of the Museum collectors lately obtained individuals from Ranígunj, a place within 120 miles of Calcutta. On the Parisnáth hill it occurs up to about 3,000 feet. It is as yet



unknown from any place of the south part of India, or from Eastern Bengal. The 'Tille Naudon' of the Coromandel coast with which it has been said to be identical, is certainly not *T. Indica*, but, as M. Milne-Edwards has stated, *T. Leschenaultii*, which also occurs at Ranígunj. A fine series of specimens of the present species has lately been received from my friend Captain Stewart Pratt of Morar, who has furnished me with some interesting notes respecting the habits of the species.

***Telphusa lugubris*, n. sp. Pl. XII, Figs. 5—7.**

The carapace is very greatly broader than long, distinctly punctate and somewhat flattened posteriorly; the cervical suture curves forwards and outwards to the rudimentary epibranchial teeth; the hepato-gastric area thus limited off is convex in every direction, and only marked mesially by a long tolerably deeply imprinted mesogastric furrow which exhibits a tendency to bifurcation at its posterior extremity; gastric area marked with two larger puncta, one being situated at each horn of the mesial crescentic portion of the cervical suture, from which two shallow hardly indicated longitudinal depressions pass backwards, one on each side of the middle line dividing the cardiac from the convex branchial regions; the sub-division of these into posterior and anterior lobes is scarcely perceptible. Oblique granulated rugosities mark the whole surface of the branchial area, becoming more numerous on the posterolateral margin, whence they sweep downwards and forwards on to the floor of the branchial chamber. Latero-anterior margin with a short obscurely granulated carina. Postfrontal crest continuous from the mesogastric furrow to the epibranchial teeth, its epigastric portion is wrinkled and bent forward, and it becomes almost effaced behind the inner canthus of the eyes. Front rough, deflexed, with a sinuous obsolete granulated free border. Orbits very high, with crenulated margins; extra-orbital angles little developed, separated from the epibranchial teeth by a long, granulated, oblique and nearly straight external border; anterior pleural lobes broad, nearly smooth, distinguishable from the inflected portion of the carapace by the termination of the rugosities with which the latter is ornamented. The epistoma is smooth and lighter in colour

than the rest of the animal, concave both transversely and longitudinally; its posterior margin sends backwards and downwards a short triangular process, but it is not notched.

The external maxillipedes and their exopodites are coarsely punctate, and appear minutely granular under a lens.

The chelipedes are greatly unequal in both males and females, the convex posterior surfaces of the meropodites are excavated into extremely shallow communicating foveæ; the posterior angles are rugose and rounded off; their ventral surfaces have smoothly tuberculated margins. The carpopodites are minutely foveate above, and punctate and armed on the inner margin, with a short obtuse spine; the succeeding joint is punctate, foveate and granular, and its distal prolongation shows more distinctly these characters, and in young specimens only is in contact with the whole length of the dentated inner edge of the dactylopodite; the teeth and tips of the pincers have both the colour and transparency of amber.

The ambulatory legs are punctate; the dorsal edges of their meropodites are scabrous, and nearly straight, the last joints are extremely stout, and well armed with amber-like spines.

The abdomen in general form resembles that of *Telphusa Indica*, or of *Paratelphusa spinigera*.

Breadth, ..... 52 mm.

Length, ..... 36 mm.

In colour this species is of a rich dark brown above, below lighter but brighter; the inter-articular membranes are straw coloured, and the teeth of the pincers and the spines on the terminal joints of the ambulatory legs are, as has been described, amber-like. The epidermis is very delicate, rapidly cracking and peeling off after death, and on exposure to the air, when removed from the spirits of wine.

*Hab.* Pankabaree (about 2000 feet at the base of the Sikkim hills); Teesta valley and Eastern Sikkim at 3—4000 ft.; Thancote hills, Nepál; Cherra Punjí in the Khasi hills.

Plate XII. Fig. 5. *Telphusa lugubris* of the natural size. 6. External maxillipede. 7. Abdomen of the male.

**Telphusa Stoliczkana, n. sp. Pl. XII, Figs. 8—12.**

Carapace much broader than long, smooth, punctate, minutely granular under a lens; cervical suture distinctly marked mesially, continued outwards and forwards on each side as a shallow depression which disappears posteriorly to the postfrontal crest, limiting off the gastric area from the branchial lobes, the anterior halves of which are distinguished from the posterior by their greater convexity; cardiac region perceptible; antero-lateral margin carries a not very salient epibranchial tooth, which is separated from the extra-orbital angle by the oblique tuberculated external margin of the latter, and passes backwards for a short distance as a tuberculated crest; postero-lateral margin covered with rugosities from which spring a few hairs; the inflected part of the carapace is more obscurely rugose; the posterior and anterior pleural lobes are smooth, the latter being separated from the former, and from the inflected portion of the carapace by a granulated line; infra-orbital margins crenulate; front narrow, granulated; its free margin is deeply bayed, having in consequence a bilobed appearance; postfrontal furrow smooth, bounded posteriorly by a well defined crenulated crest which passes from the mesogastric furrow to the epibranchial teeth in an uninterrupted straight line, that part of it which forms the frontage of the epigastric lobes being rugose.

The posterior margin of the epistoma is smoothly tubercular, but those parts of it which go to form the boundaries of the efferent apertures of the branchial chambers are entire.

The chelipedes are greatly unequal in males and sub-equal in females; the meropodites are rugose and have a few hairs near the base of the posterior angle; the carpopodites are rugose above and bear a strong sharp spine in the usual position and beneath it a smaller one; the pincers are multidentate and their arms cross at the extremities.

The ambulatory legs are very long; their meropodites resemble those of *Telphusa longipes*, Alph. M.-Edwards, but their penultimate joints are longer in proportion to their breadth and the last joints are stouter and more elongated.

Length of the female specimen described, . . . . 30 mm.

Breadth, . . . . . 40 mm.

Length of a male, . . . . 36 mm.

Breadth, . . . . . 48 mm.

The greater difference between the length and breadth in the male specimen is only apparent, being entirely due to the greater mesial excavation of the front.

A male and a female of this species were collected during a trip to the Malayan peninsula and presented to the Indian Museum together with an interesting series of marine Crustacea by Dr. Stoliczka.

*Hab.* Penang.

Plate XII. Fig. 8. *Telphusa Stoliczkana* of the natural size.  
9. External view of right chela. 10. Abdomen of the female.  
11, Do. of the male. 12. External maxillipede.

(*To be continued in the next number of the Journal.*)



# JOURNAL

OF THE

# ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

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No. III.—1871.
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ON INDIAN AND MALAYAN TELPHUSIDÆ, Part I,—  
by J. WOOD-MASON, Esq.

(With pl. xiii, and xiv.)

(Continued from p. 200).

**Telphusa lævis**, n. sp., pl. xiv, figs. 1—6.

The carapace is narrow especially posteriorly, cordiform, smooth, extremely convex in every direction, finely granulated and punctate, unbroken by interregional furrows, the posterior boundary of the gastric area alone being faintly indicated; epigastric lobes hardly perceptible in some specimens; post-frontal ridge feebly developed, interrupted, most apparent behind the eyes; postero-lateral margins rounded off, marked with extremely delicate oblique wrinkles which pass downwards and forwards on to the branchial floor which is much swollen; antero-lateral margins rounded, inclined, bearing rudimentary epibranchial teeth which pass backwards and inwards for a short distance as an obscure, crenulated crest. Front broad, deflexed, terminated by a nearly straight free margin; its anterior third flattened and perfectly vertical. Orbits oval with obscurely crenated margins, not at all salient; their external angles scarcely projecting beyond the general level of the orbital margins; anterior pleural regions convex, finely granulated, separated near their internal boundaries from the rest of the inferior surface of the carapace by a well defined, finely tuberculated line, passing directly

downwards from the epibranchial teeth. The posterior margin of the peristoma has a median rounded projection, notched on each side. The chelipedes are very unequal, in some specimens the right, in others the left being the larger; meropodites with their dorsal edges sharply rugose; carpopodites also rugose with their inner margins armed in the usual manner with a sharp tooth, beneath which is a smaller one; the propodite of the larger claw is extremely convex, smooth, granulated and near its extremity canaliculate, punctate, and with the granulations passing into minute sharp spinules; the dactylopodite is similarly marked and is in contact with the extremity only of the produced portion of the penultimate joint in the larger claw.

The ambulatory legs are thin, slender, and rugose.

Length, ..... 16 mm.

Breadth, ..... 21 mm.

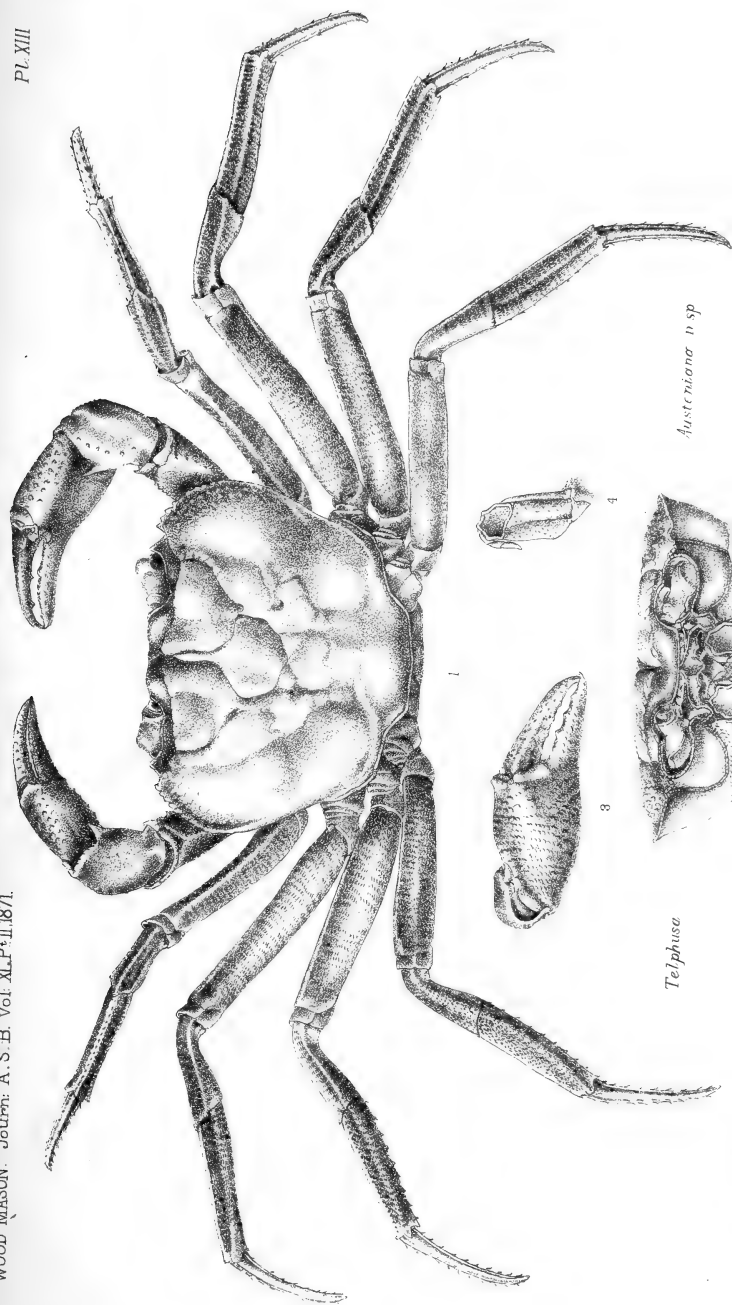
*Hab.* Cherra Púnjí; Goalparah.

Plate XIV. Fig. 1. *Telphusa lævis*, nat. size. 2. Front view. 3. External maxilliped. 4. Chela. 5. Do. of another specimen. 6. Abdomen of male.

#### TELPHUSA LESCHENAUILLII.

Milne-Edwards, Hist. Nat. des Crust., Tom. II, p. 13, Ann. des Sc. nat., III. Sér., Tom. XX, p. 211. Heller, Reise der Fregatte Novara, Crustaceen, p. 32. Alph. Milne-Edwards, Révision du genre *Telphusa*, Nouvelles Archives du Muséum, 1869, Tom. V, p. 165, pl. viii, fig. 3, 3a.

Carapace convex from behind forwards and transversely; front broad, especially at base, sinuous, produced, with a sharp chisel-like free edge; anterior boundary of the epistoma almost straight, sending forwards a small median process which indents the sub-frontal lobe, scarcely taking any share in the formation of the inter-antennular septum; posterior edge divided by two distinct notches into three rounded lobes, the median one of which is largest, lateral lobes internally rounded but passing almost straight outwards to form the anterior boundaries of the orifices for the egress of the water that has served for respiration. Post-frontal crest interrupted, divided into two external larger and two internal slightly advanced smaller portions which together equal in width one of the former; antero-lateral margin armed with an epibranchial tooth



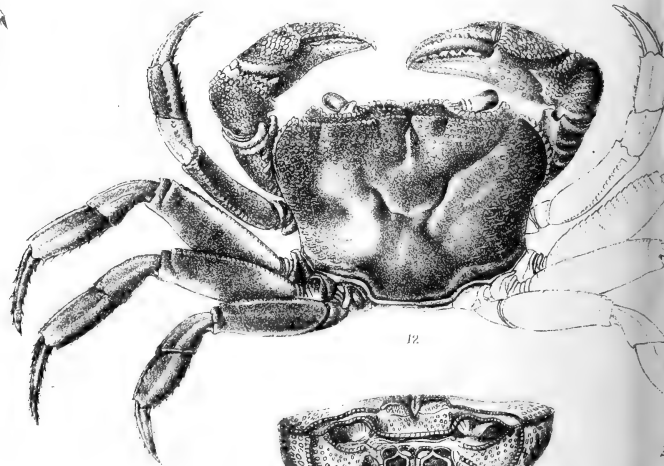
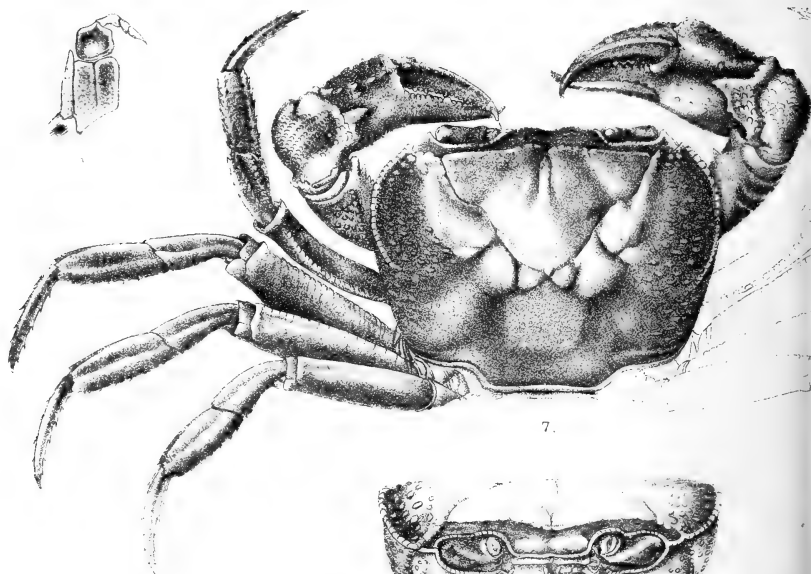
*Austriania n. sp.*

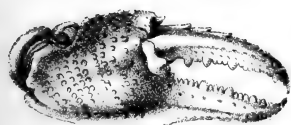
*Telphusa*











10



6



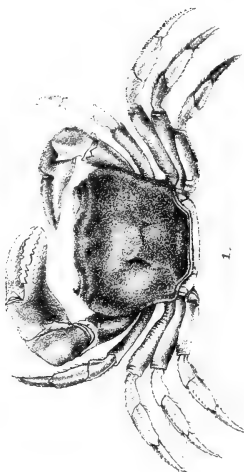
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11



15



1



2



16



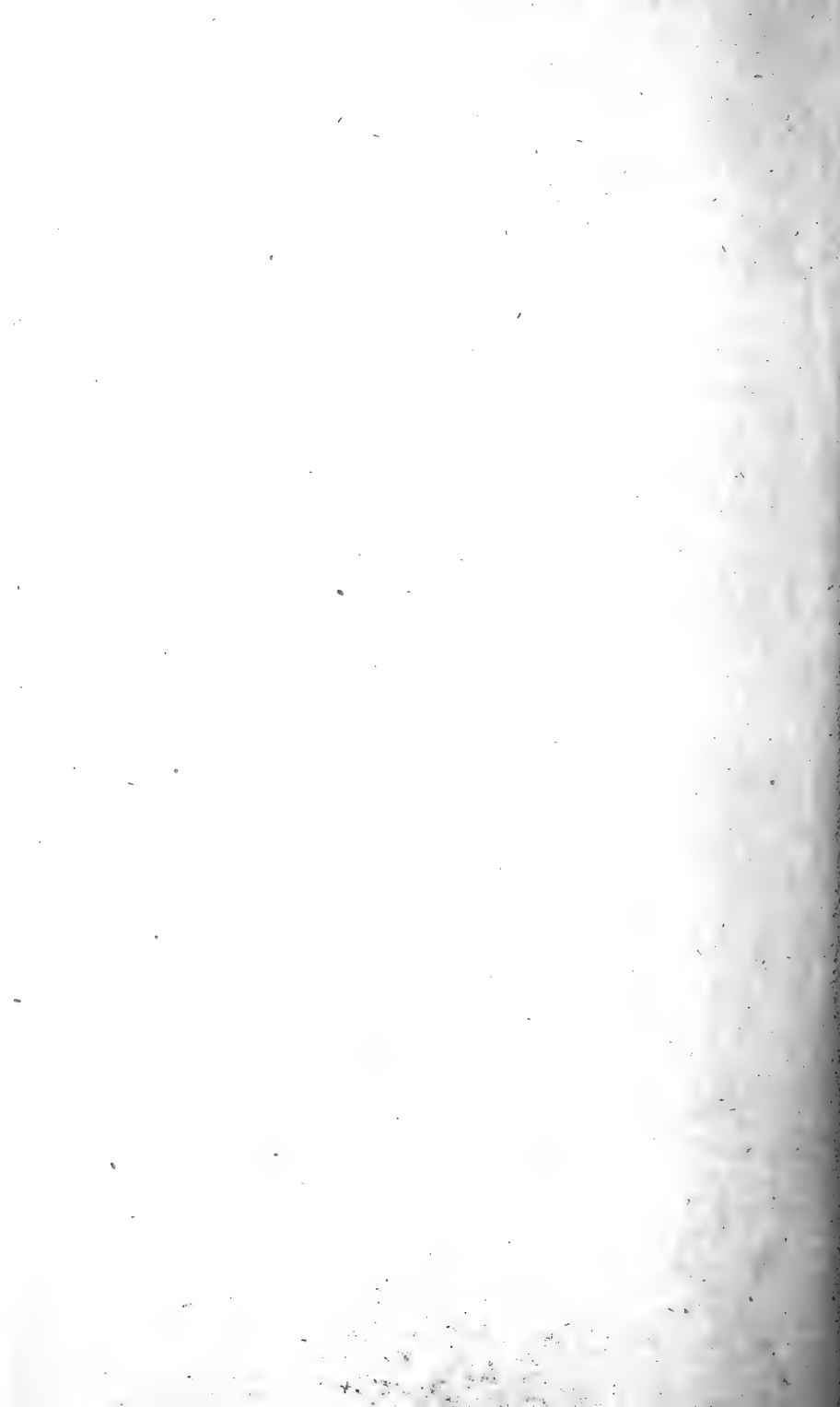
3



4



4



continued backwards and inwards as a sharp, finely crenulated crest. The surface of the carapace, especially anteriorly, appears minutely granular under an ordinary lens, its sides behind the points at which the cristiform continuations of the epibranchial teeth subside are marked with oblique sub-parallel corrugations. The four posterior pairs of ambulatory legs are extremely thin; the posterior flat faces of their meropodites are raised into coarse granulations, while the anterior surfaces remain smooth; the dactylopodites are extremely slender, acute. Chelipedes subequal, dactylopodites in contact throughout their entire length with the propodites the outer faces of which are smooth and convex; carpopodites furnished internally with a long sharp spine, beneath which is a smaller one; meropodites corrugated on their posterior surfaces.

I am unable to verify Heller's statement that the crest on the latero-anterior margin is smooth in the females.

Hab. Ranígunj; Pondicherry; Madras; Ceylon; Malabar coast; Mauritius; Nicobar Islands and probably many other islands of the Indo-Malayan archipelago; and Tahiti.

#### TELPHUSA GUERINI.

*Telphusa Guerini*, Milne-Edwards, *Mélanges Carcinologiques*, p. 176; Alph. Milne-Edwards, *Nouv. Archives du Muséum*, 1869, Tom. V, p. 182, pl. xi, fig. 4, 4a et 4b.

*Telphusa planata*, Alph. Milne-Edwards, *Nouv. Archives du Muséum*, 1869, Tom. V, p. 181, pl. xi, fig. 3, 3a et 3b.

*Telphusa planata* is given as a synonym of *T. Guerini*, M.-Edw., with doubt, although M. Alph. Milne-Edwards' description of the former applies exactly to individuals amongst my series of examples of the latter.

Hab. Concan and Khándalla, Western Gháts, near Bombay; Belaspúr.

#### *Telphusa Austeniana*, n. sp., pl. xiii.

Carapace much broader than long, flattened in the middle posteriorly to a line passing through its widest part; protogastric lobes convex, separated from one another by the narrow forward prolongation of the meso-gastric lobe; meso-gastric furrow passing into the post-frontal, deeply dividing the two epigas-

tric lobes which are all but confluent with the protogastric : branchial lobes convex, each divided by a transverse valley into an anterior and posterior portion ; postero-laterally to the gastric region the surface of the carapace is raised on each side into an irregular areolet bounded antero-laterally by the epibranchial, behind by the meta-branchial lobe from which the cardiac area is separated by an indistinct longitudinal depression ; post-frontal furrow deeply excavated behind the eyes ; post-frontal crest scarcely interrupted by the advanced position of the epigastric lobes, continued outwards on each side from the meso-gastric furrow in an irregular, rugose line to the epibranchial teeth ; these pass backwards, as prominent dentate crests and, with the extra-orbital teeth, are extremely salient ; orbital margins finely crenated ; front deflexed, wider at base than at its free margin, raised into two eminences one on each side of the middle line ; antero-lateral portions of the branchial regions marked with numerous coarse granulations ; postero-lateral margins and the parts of the carapace which form the floors of the branchial cavities rugose. Chelipedes slender ; chelæ externally rugose, covered, especially on their infero-internal surface, with small rough tubercles. Carpopodites above rugose with a longitudinal row of tubercles near their inner margins, from which there projects a very sharp spine with a smaller one below it. Ambulatory legs enormously long and slender by which character alone it is possible at once to distinguish *T. Austeniana* from all its known congeners.

Breadth, ..... 48 mm.

Length, ..... 35 mm.

Length of carpopodite of 3rd pair of ambulatory legs = 34 mms. or nearly equal to the length of the carapace.

*Hab.* Cherra Púnjí ; the only specimen obtained is a female.

Plate XIII. Fig. 1. *Telphusa Austeniana*, nat. size. 2. Front view. 3. Chela. 4. External maxilliped.

*Telphusa Pealiana*, n. sp., pl. xiv, figs. 7—11.

Carapace thick, not much broader than long, convex from behind forwards ; its areolation is similar to that of *Telphusa Atkinsoniana* ; the cervical suture cuts through the post-frontal crest about 5 millimetres internally to the epibranchial teeth ; these are moderately salient ; the branchial region is somewhat convex and covered anteriorly with coarse irregular granulations ; antero-lateral margin inclined,

surmounted by an evenly denticulated crest; postero-lateral margin covered with oblique wrinkles which pass forwards and downwards on to the inflected portion of the carapace; posterior pleural lobe, where it is bounded by the anterior pleural, rugose; the latter is limited off by a line of regular bead-like tubercles; post-frontal crest, continuous to the epibranchial teeth from the meso-gastric furrow, curving forwards mesially and at each end; post-frontal furrow smooth behind the eyes; front narrow, deflexed, raised into a bilaterally symmetrical pair of eminences. Chelipedes subequal in the only specimen* (a female) in my possession; the meropodites are tuberculately rugose on their posterior surfaces and their ventral angles are beset with long tubercles; the carpopodites are rugose above and their inner margin is armed with a very sharp long spine from the sides of which spring 2 or 3 minute cusps; beneath the larger spine a smaller one is to be seen. The penultimate joint is externally rough, internally near the inferior margin tuberculated and above presents a few spiniform tubercles; the dactylopodite which is in contact with the other arm of the pincers throughout its length line has a few spinules above near its proximal end.

Length, ..... 32 mm.

Breadth, ..... 41 mm.

The posterior pair of ambulatory legs has not been preserved, but from those that remain, it will be seen that the penultimate joints resemble slightly those of *Telpusa Austeniana*, and of *T. Stoliezkanæ*. I have named this species after Mr. S. E. Peal, to whom the Indian Museum is indebted for many novelties in the various groups of Arthropoda.

*Hab.* Sibsaur, Assam.

Plate XIV. Fig. 7. *Telpusa Pealiana*, nat. size. 8. Front view. 9. External maxilliped. 10. Chela. 11. Abdomen of male.

### *Telpusa Atkinsoniana*, n. sp., pl. xiv, figs. 12—16.

The carapace is much broader than long, smooth, punctate mesially and posteriorly; the anterior branchial lobe is not greatly swollen above, is covered anteriorly with coarse granulations; epigastric lobes granulated, separated behind and laterally from the granulated proto-gastric and from one another by the meso-gastric

* Several specimens of each sex have been received from Mr. Peal since the above went to press.

furrow; postfrontal crest well developed, most distinctly tuberculated, curving slightly forwards at each end and passing completely into the epibranchial teeth, notched on each side externally to each epigastric lobe and internally to each epibranchial tooth; epibranchial teeth salient, separated from the denticulated margins of the prominent extra-orbital angles by a notch, curving backwards as regularly dentate crests; orbital and frontal margins conspicuously tuberculated; front moderately broad, deflexed, covered with rounded tubercles, smooth in the middle line, terminating in a nearly straight free margin. Postero-lateral margins marked with oblique rugations which gradually assume a tuberculated character as they pass forwards on to the inflected portion of the carapace; anterior pleural lobe beset in the centre with irregularly disposed rounded tubercles, limited off from the surrounding area by a regular line of larger bead-like tubercles.

Chelipedes subequal, densely tuberculated; meropodites with all their angles sharply tuberculated; carpopodites above granulately rugose and becoming towards the inner margin tuberculated, the tubercles extending on to the sides of the spine; beneath this spine is a smaller one from which passes upwards and towards the proximal articular extremity of the joint a row of two or three spiniform tubercles; externally the penultimate joint is excessively tuberculately granulated, the tubercles becoming very coarse and irregular in aged specimens, and on the upper border passing into spiniform tubercles in specimens of all ages; the superior margin of the dactylopodites is also beset with spiniform tubercles and their inner toothed margin is in contact throughout its length with the other arm of the pincers; the extremities of these are tipped with a blackish colour which is capable of defying the blanching action of spirit for years.

I will not venture to describe the precise distribution of the colours of this beautiful species, because I omitted to note them particularly when I received the specimen which has been chosen for description fresh from the hands of Dr. Stoliczka, but I can say that the inferior surface generally and the inner aspects of the chelipedes are suffused with a beautiful violet colour, the tubercles and spines offering their bright red tips in remarkable contrast



Breadth, ..... 38 mm.

Length, ..... 28 mm.

*Hab.* Darjeeling; Thancote Hills, Nepal; Khasi Hills (?).

I have much pleasure in connecting with this beautiful species the name of Mr. W. S. Atkinson.

Plate XIV. Fig 12. *Telphusa Atkinsoniana*, nat. size. 13. Front view. 14. External maxilliped. 15. Chela. 16. Abdomen of male.

(To be continued in the next number of the Journal.)

NOTES ON BIRDS OBSERVED IN THE NEIGHBOURHOOD OF NAGPORE AND KAMPTEE, (CENTRAL PROVINCES), CHIKALDA AND AKOLA IN BERAR, —by Lieut.-Colonel A. C. McMASTER, Madras Staff Corps.

[Received 24th February, 1871.]

These rough notes were taken during hunting and shooting trips from Kamptee. The natural history of Chikalda is interesting, as, in addition to many birds and beasts commonly found in the plains, some hitherto supposed to have been restricted to particular localities meet each other on the neutral ground of these hills.

The names and numbers here given are taken from Jerdon's "Birds of India."

No. 6. *NEOPHRON PERCNOPTERUS*.—I found this bird breeding near Kamptee in January.

No. 29. *AQUILA FULVESCENS*.—Kamptee.

No. 38. *CIRCAETUS GALLICUS*.—I saw one of these fine birds attempt to carry off a Cobra in the public gardens at Chikalda; my approach drove the eagle away from the reptile which, however, it had crippled completely.

No. 56. *MILVUS GOVINDA*.—Jerdon says, that the kite "breeds from January to April, beginning to couple about Christmas." I have seen them building at Kamptee in November, December and January.

No. 65. *SYRNIUM SINENSE*.—I got a pair of these beautiful owls and a fully fledged young one at Gogee in Wurda district, on the 10th of March; they must, therefore, like most other birds of prey, pair early in the cold season.

No. 82. *HIRUNDO RUSTICA*.—Kamptee and Nagpore.

No. 84. *HIRUNDO FILIFERA*.*—I found these birds in small companies at Chandkee Khopra and Gojee in the Wurda district in December and February, and in January, a pair with a nest, open at the top, on a rock overhanging the river at Mahadulla, 16 miles from Kamptee.

No. 90. *COTYLE CONCOLOR*.—Some birds were obtained by me at Chikalda, 3700 feet, in May.

No. 98. *CYPSELUS MELBA*.—I saw several very fine swifts, which seemed to be this species, at the old fort Gawilgarh and at Chikalda, 3700 feet, in April and May, but could not get a specimen. They appeared to be breeding about the perpendicular cliffs on which Gawilgarh is perched.

No. 100. *CYPSELUS AFFINIS*.—Abounds at Kamptee, but the birds burrowed so deeply into the thatched roofs that I could never get a nest. The burrows were very neatly made and some perfectly round.

No. 117. *MEROPS VIRIDIS*.—I have found *torquatus* at Chandkee Khopra in Wurda in December, and *ferrugiceps* at the same place and time. Are not both of these accidental varieties of *M. viridis*? I also found *torquatus* at Chikalda in May; is the peculiar coloration of the throat the breeding dress of the female?

No. 118. *MEROPS PHILIPPENSIS*.—Abundant about Kamptee during the hot weather and rains (breeding season?). I think they breed here, but have not been able to get their nests, although, if these are to be found, they should be in the banks of the river, where it runs past the Military Cantonment.

No. 127. *HALCYON LEUCOCEPHALUS*.—Chandkee Khopra, Wurda district, in December.

No. 129. *HALCYON FUSCUS*.—Abundant throughout the district.

No. 144. *MENICEROS BICORNIS*.—Not rare about Chandkee Khopra in Wurda.

No. 147. *PALÆORNIS ALEXANDRI*.—One I killed near Kamptee was considerably larger than the size given by Jerdon. They appear to be more abundant in the cold season than at other times.

* I think that a large colony of *HIRUNDO FLUVICOLA* were breeding on a rock, or broken bridge (I forget which) overhanging the river at Akola in West Berar, during the last week in December.

No. 164. *YUNGIPICUS HARDWICKII*.—I got one at Chikalda, 3700 feet.

No. 181. *BRACHYPTERNUS CHRYSNOTUS*.—Chikalda.

No. 188. *YUNX TORQUILLA*.—Chikalda, in April.

No. 193. *MEGALAIMA CANICEPS*.—There are scores of these birds about Chikalda and the hill fort of Gawilgarh. I have heard them calling at all hours during the night, even when there was no moon. Those I have killed generally had the bristles about their bills covered with gummy matter, evidently from some fruit.

No. 197. *XANTHOLÆMA INDICA*.—At Kamptee I saw one of these birds sitting on the ground beside a small water-course in my garden, it probably came down to drink ; except on this occasion I have never seen a barbet on the ground. A pair bred in my garden at Bellary in the cross beam of a vinery, and at Bombay I found a nest in the dead branch of a tree close to the house. The entrance was so small, that it was difficult to believe that the bird could get through it; it was perfectly circular and as well bored as if it had been cut with an anger ; the hole was not more than 18 inches in depth, but the little carpenter was busily employed in enlarging it by cutting out very small chips and throwing them about the spot ; as far as could be judged from probing, the inside appeared beautifully smooth.

No. 199. *CUCULUS CANORUS*.—This bird is very abundant at Russelcondah in Goomsoor during the rains, coming into the gardens and close to the houses. I have seen and heard it in the Golconda zemindary and at Goodum, in April, at Saugor in June, and within three miles of Kamptee on the 15th of June ; a friend heard it at Chikalda on the 5th of June.

No. 212. *COCCYSTES MELANOLEUCOS*.—I killed one at Kamptee on the 4th of July.

No. 220. *TACCOCUA SIRKEE*.—I got one at Chikalda, but my bird had the brown above "*washed with green*" as in No. 221 of Jerdon. Could it have been that variety ? or was it No. 222 ?

No. 234. *ARACHNECHTHRA ASIATICA*.—I can confirm Mr. Blanford and Dr. Jerdon's statements that the female retains her dull colours in the breeding-season.

No. 255. *UPUPA NIGRIPENNIS*.—Abundant at Chikalda in May,

but appears to leave the plains during the hot season and rains; the first I saw at Kamptee in autumn was on the 14th of October. At Madras I found (February 24th) a hoopoe's nest in a hole in a tree close to the club, there were two fully fledged young birds in the nest, about which there was not the faintest trace of evil stench, (vide page 391 of Jerdon).

No. 257. *LANIUS ERYTHRONOTUS*.—I have found this bird at Kamptee, and agree with Mr. Blanford, that it varies greatly in size and somewhat in plumage within the same district.

No. 278. *DICRURUS MACROCERCUS*.—Jerdon says that he has never seen the king crow fix on the back of a hawk with claws and beak. At Rangoon I saw one thus fix itself on a cattle egret feeding on the ground, hit the latter hard on the head with its beak, and repeat the assault several times, the reason apparently being that the other bird had secured some insect on which the king-crow had set his heart. At Kamptee I saw one fix on the back of an owlet (*Athene Brama*), and maintain its hold while the latter was flying for several yards; and on another occasion I saw a king-crow pursue the common bee-eater until the latter dropped an insect which was seized by the Drongo before it reached the ground.

No. 288. *TCHITREA PARADISI*.—This beautiful bird is not rare in the Nagpore country, I have seen it close to Chikalda, 3,700 feet. Jerdon says he has not seen it higher than about 2000.

No. 293. *LEUCOCERCA PECTORALIS*.—Jerdon says that he has only found this bird on the Neilgherries at an elevation of 6000 feet. Mr. Blanford got it near Chanda in forests, his specimens were dusky on the back and rather rufous on the abdomen. I got it at Chikalda in May, colours as described by Jerdon.

No. 300. *OCHROMELA NIGRORUFA*.—This has I think been seen by me among the cliffs a few miles west of Chikalda.

No. 305. *CYORNIS BANYUMAS*.—I got two or three specimens of this fly-catcher at Chikalda in May.

No. 306. *CYORNIS TICKELLIÆ*.—Jerdon says that this bird has only as yet been procured in Central India, and by Tickell. Mr. Blanford got one at Seoni, another near Chanda (*Asiatic Society's Journal*, Vol. xxxviii, p. 173). He seems to think the sexes are

alike in plumage; on this point I agree with Mr. Blanford. The sex of the specimen I shot at Chikalda was not ascertained, but the two birds seen appeared to be a pair, and were alike in plumage. (Berar Gazetteer, page 57).

No. 342. *MYIOPHONUS HORSFIELDII*.—Jerdon says that this fine thrush is "found throughout the forests of Southern and Western India, from near the top of the Neilgherries (6000 feet) to almost the level of the sea * * * *; but it is not found in any of the forests of the Eastern Ghats, nor in Central or Northern India. It especially delights in mountain torrents; and if there is a waterfall it is sure to be found there." I got a pair of these very handsome birds, being first attracted by their fine clear notes, in a dry bed, which in the rains must become a torrent and waterfall, a short distance beyond James' point, about three miles west of Chikalda. Others will probably be seen. The birds at this season (May) are wary, and difficult to watch. (Berar Gazetteer, page 57).

No. 345. *PITTA BENGALENSIS*.—I killed one in my garden at Kamptee on the 2nd of October; I have known three cases of these birds taking refuge in houses as described at page 504 of Jerdon's work.

No. 351. *PETROCOSSYPHUS CYANEUS*.—One of these silent and solitary birds may be seen in almost every village in the Wurda district in December. Both of the houses I occupied at Kamptee had one which sheltered itself under the eaves during the cold season. In Burma, this is the tamest and most confiding bird I have ever seen: it not only frequently enters the verandahs, but the inner rooms of houses, and is almost startling in its noiseless and uncanny familiarity. Whilst at Tonghoo, I had, every season, one or two of them about my house, so fearless, that they might almost have been handled. I saw one, in my verandah at Rangoon, kill and swallow a large scorpion.

No. 359. *MERULA NIGROPILEUS*.—Chikalda, April or May.

No. 446. *HYPSSIPETES GANEESA*.—At page 58 of the Berar Gazetteer, I mentioned that I had got this bird at Chikalda and remarked that its habits were exactly those of No. 446, *H. NEILGHERRIENSIS*.—I have since found in the Appendix, page 872, volume 3 of Jerdon, that the birds are identical.

No. 460. *OTOCOMPSA JOCOSA*.—I shot this bird at Chikalda in May; Jerdon says it is rare in the Central table land; Blanford never saw it in Central India; it has probably followed the chain of Western Ghats northward from the Neilgherries where it is very abundant

No. 464. *PHYLLORNIS MALLABARICA*.—Chikalda, in June.

No. 470. *ORIOLOUS KUNDUO*.—I found several nests of this bird at Kamptee during June and July; they corresponded exactly with Jerdon's admirable description, at page 108, volume II. Has any writer mentioned that this bird has a faint, but very sweet and plaintive song which he continues for a considerable time? I have only heard it when a family, old and young, were together, *i. e.*, at the close of the breeding season.

No. 473. *ORIOLOUS CEYLONENSIS*.—I got either this bird, or No. 472, at Chikalda, and agree with Mr. A. Hume, who (J. A. S. B. 1870, p. 118) utterly disbelieves in "*Ceylonensis*" as a distinct species.

No. 480. *THAMNOBIA CAMBAIENSIS*.—Three pairs of these birds built about the roof of my house at Kamptee. One nest was composed of coir matting stolen from me and lined with the red wool which had dropped from an old carpet daily beaten near the spot; there were no snake skins in the nest (*vide* Jerdon), but in it were two or three pieces of the brilliant mica, so abundant at Kamptee, and these very much resembled scales from snake skins.

No. 497. *RUTICILLA RUFIVENTRIS*.—I first remarked this bird at Kamptee on the 1st of October and there were a good number here on the 3rd March. Does it change its colour in summer? The rufous tints struck me as becoming paler and more yellowish in February and March; I was told of a mistake about the nest of this bird, similar to that mentioned at page 138, Volume II, of Jerdon.

No. 556. *PHYLLOSCOPUS MAGNIROSTRIS*.—I think I got this bird at Chikalda in May.

No. 569. *CULICIPETA BURKII*.—A pair of these pretty little birds was obtained at Kamptee in February, and others were not uncommon in May at Chikalda, where they probably breed.

No. 604. *AGRODROMA SORDIDA*.—I found the nest of this bird near Kamptee in April in a hole in black cotton soil, there were three or perhaps four young in the nest.

No. 645. *PARUS CINEREUS*.—I think I saw this bird on the Ghat between Ellichpoor and Chikalda, at an elevation of nearly 3000 feet.

No. 648. *MACHLOLOPHUS JERDONI*.—Chikalda, April and May.

No. 660. *CORVUS CULMINATUS*.

No. 663. *CORVUS SPLENDENS*.—The local distribution of these birds puzzles me sadly. Both abound at Bangalore and Madras, while *culminatus* is the only crow of the Neilgherries, replacing his grey cousin at Kullar, the posting-stage at the foot of the Kúnúr Ghát to which place and no further *splendens* had penetrated in 1870. I could not find *culminatus* at Waltair, and during two years at Kamptee have never seen it in that station, but have occasionally found it at some of our hog-hunting meets in the Wurda district and at Akola. It was moreover the only crow on the Chikalda hills during April and May: with the first rains, however, in June, *splendens* appeared there; (Berar Gazetteer, page 58).

Is *culminatus* to be found at Bombay?

Common and familiar as crows are—living almost as much in houses as near them—the act of coition has never—so say the natives of Burma and, I believe, of many parts of India—been observed; and, certainly, for more than twenty years, since first hearing the statement, I have carefully watched for an opportunity of refuting it without success. Just at dawn, I think, I have twice observed crows thus engaged and on the nest; but I am not certain, and I have never met any one who could own to having seen even as much. I have not a copy of the book, so quote from memory, but, in the “Laws of Menu,” (the origin of Bhudhist and Hindu notions) it is set forth that “a good wife should be like a crow,” *i. e.*, that she should not allow any conjugal endearments or familiarities before spectators.

The Burmese representatives of *splendens* are much darker than those in India, but an excellent naturalist remarks that such is the case with the Burmese varieties of many birds found in both countries; for instance, I can think of the Burmese Paradise

Fly-catcher, (*Tchitrea affinis*); the Burmese Roller (*Coracias affinis*); the Burmese Pea-fowl (*Pavo muticus*); and the Burmese variety of the Red Jungle Fowl (*Gallus ferrugineus*).

Wide awake as the crow is during the day, she is, when once gone to roost, a most stupid and difficult bird to rouse. I have almost pushed them one by one from their perches, in low trees, very shortly after sunset.

It is interesting to watch these birds at Rangoon when a storm is coming on. Up to the last moment they appear to be intent on foraging: then, just before the storm bursts, the air is alive with hundreds of them flying in all directions, but each one going direct as a bullet to his own tree or clump of bamboos. I have often timed my taking shelter from a shower coming on by watching their movements.

No. 648. *DENDROCITTA LEUCOGASTRA*.—Jerdon says that this bird has only been found in some of the jungles of the Malabar coast. I got it at Chikalda in May.

No. 724. *MELOPHUS MELANICTERUS*.—I got this bird in May at Chikalda in Berar, and as I have seen it in pairs, fancy that it breeds there; it is a shy bird, always on the move about the edges of cliffs and ravine, and therefore difficult to watch.

Nos. 772. *CROCOPUS PHENICOPTERUS*, and 773, *CROCOPUS CHLORIGASTER*.—Green pigeons are now (April and May) breeding at Chikalda. The nest is apparently very carelessly constructed of a few dead twigs placed haphazard at the end of a branch, but from this cause it is exceedingly well concealed, as the bough selected always appears to be a bare one, on which the dry twigs do not attract attention. Both varieties of these pigeons, and their intermediate hybrids will probably be found on these hills. (Berar Gazetteer, page 58).

No. 800. *PTEROCLES FASCIATUS*.—I never remarked the crepuscular habits of this bird until last August when at Akola, where just after dark on two occasions a small flock passed close over me. I pointed them out to a friend who has since observed the habit.

No. 802. *PTEROCLES EXUSTUS*.—I got the eggs of this bird, three in number, on the 12th of March, at Larkee in the Chanda district.



No. 813. *GALLUS SONNERATHI* and

No. 814. *GALLOPERDIX SPADICEUS*,—abound near Chikalda.

No. 839. *SYPHEOTIDES AURITUS*.—I saw a male of this bird in full breeding plumage at Akola in August, and on the 28th of October, near Nagpore, killed a cock just losing his ear tufts and very black. This should fix the breeding season of these birds in the Central Provinces and Berar between July and November.

No. 845. *CHARADRIUS LONGIPES*.—Do these birds visit the Central Provinces? I have never found one there.

No. 856. *SARCIOPHORUS BILOBUS*.—I got this Lapwing at Chikalda. It is far more silent than its relations, and runs with its back hunched and in a more game-like manner.

No. 864. *GRUS LEUCOGERANUS*.—This fine bird comes as far south as Kamptee. On the 3rd of February, I killed one at Koohee, about 20 miles S. E. of the Cantonment.

No. 871. *GALLINAGO SCOLOPACINUS*—is the snipe of the Nagpore country. At Bangalore, and on the Neilgherries, all the snipes I have killed were pintails, No. 870. At Madras, in December, out of a bag of 38 couples both varieties were in nearly equal proportion.

Nos. 872 and 873. The Jack and Painted Snipe are occasionally to be killed near Kamptee.

No. 936. *BOTAURUS STELLARIS*.—I got one of these rare birds near Kamptee on the 9th December, and another some years ago, on the 3rd January, two or three marches to the north of Saugor. One was said to have been killed near Bangalore in April, 1867.

No. 949. *ANSER INDICUS*.—I saw a large flock of these birds circling low over my house in the Kamptee Cantonment in February, and on the 23rd of the same month a very fine specimen was brought to me.

No. 961. *BRANTA RUFINA*.—A couple of these fine ducks were brought to me at Kamptee on the 14th January.

No. 971. *FULIGULA CRISTATA*.—Several of these birds were brought into Kamptee by shikarees in April.

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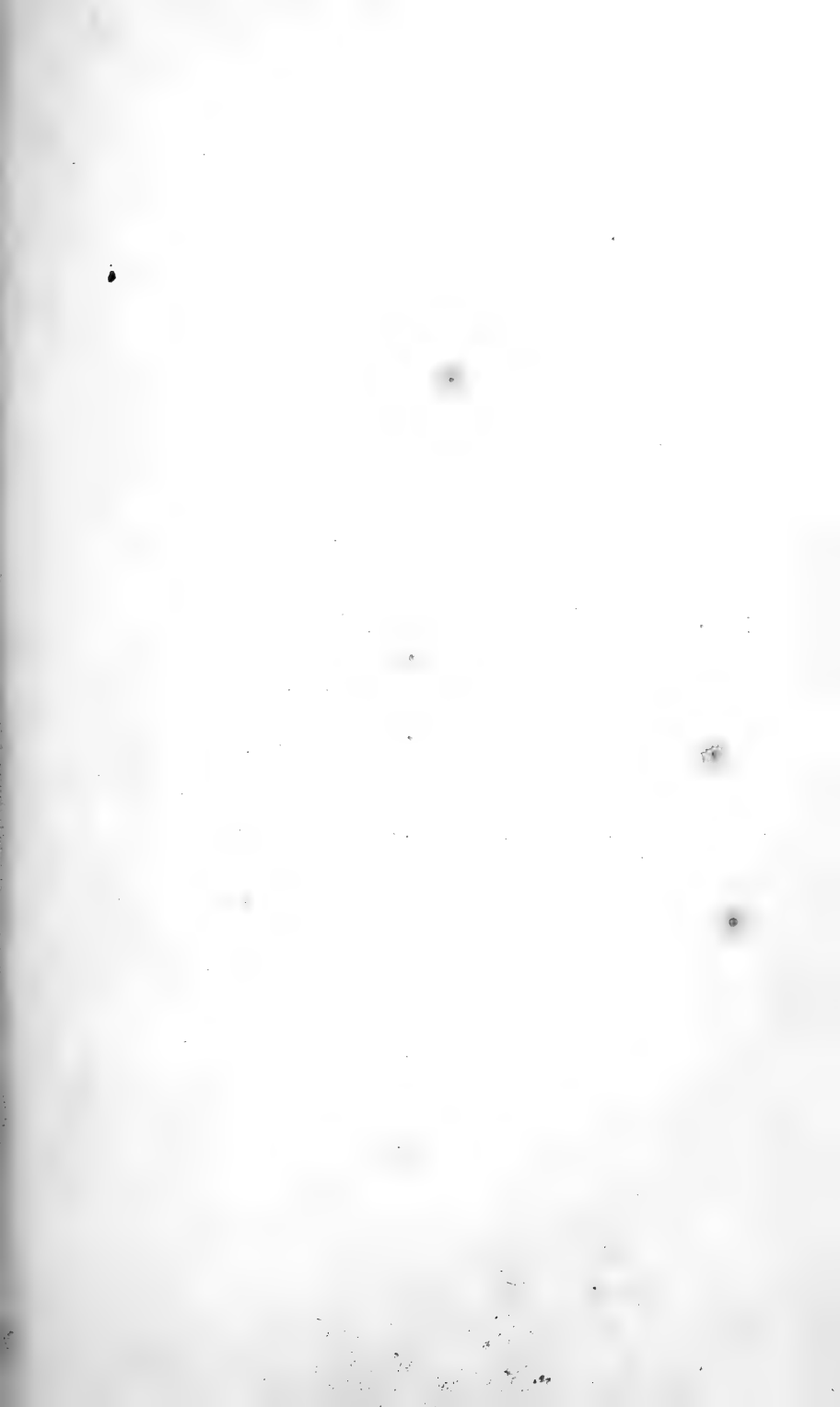
NOTE ON COLONEL McMASTER'S LIST OF BIRDS FROM NAGPORE &c.,—  
by W. T. BLANFORD.

The occurrence of several Malabar birds at Chikalda in the Gawilgarh hills is a very interesting circumstance, as it adds an instance to those already known in which animals with decidedly Malay affinities are met with on isolated hills in India, while they are wanting in the surrounding lowlands. Whether the cause of this circumstance be climatic, and due to the greater dampness of these hill tops, I cannot say, probably it may be; but it is also probable that the animals, thus found isolated, once inhabited the plains of India, and were driven by a change in the climate (which may have been in its turn caused partly by the destruction of the forests), to take refuge on the hills, their place in the lowlands being supplied, in part at least, by the numerous desert types which are spread over the Indian plains, such amongst the birds as *Neophron*, *Aquila fulvescens*, *Pterocles exustus*, *Ammomanes phenicurus* and *Pyrhulauda grisea*. That the hill birds have not migrated from other regions, but have really occupied the intervening country at one time, is rendered probable by the circumstance that animals incapable of traversing long distances, such as ground snakes (*Uropeltidae*), and land shells, have the same peculiar distribution, and the same is the case, to some extent at least, with plants.

The Malabar forms mentioned in Col. McMaster's notes as found at Chikalda are *Brachypternus chrysonotus*, *Ochromela nigrorufa*, *Myiophonus Horsfieldii*, *Hypsipetes Ganeesa*, *Phyllornis Malabarica*, and *Dendrocitta leucogastra*. *Otocompsa jocosus* (? *O. fuscicaudata*) and *Merula nigropileus* too, are not, so far as I am aware, found in the plains of Berar and the Central Provinces.

It is very desirable to learn to what extent any of these Malabar forms occur at Pachmari and on Mount Abú. A Malabar fauna has been found on several hills in Southern India. My brother and I ten years ago* called attention to the occurrence of land shells of Nilgiri species on the Shevroy, Kolamully, Patchamully and Kalryenmully hills, and on one or two minor peaks.

* J. A. S. B., xxx, p. 365.



## PLATE XV.

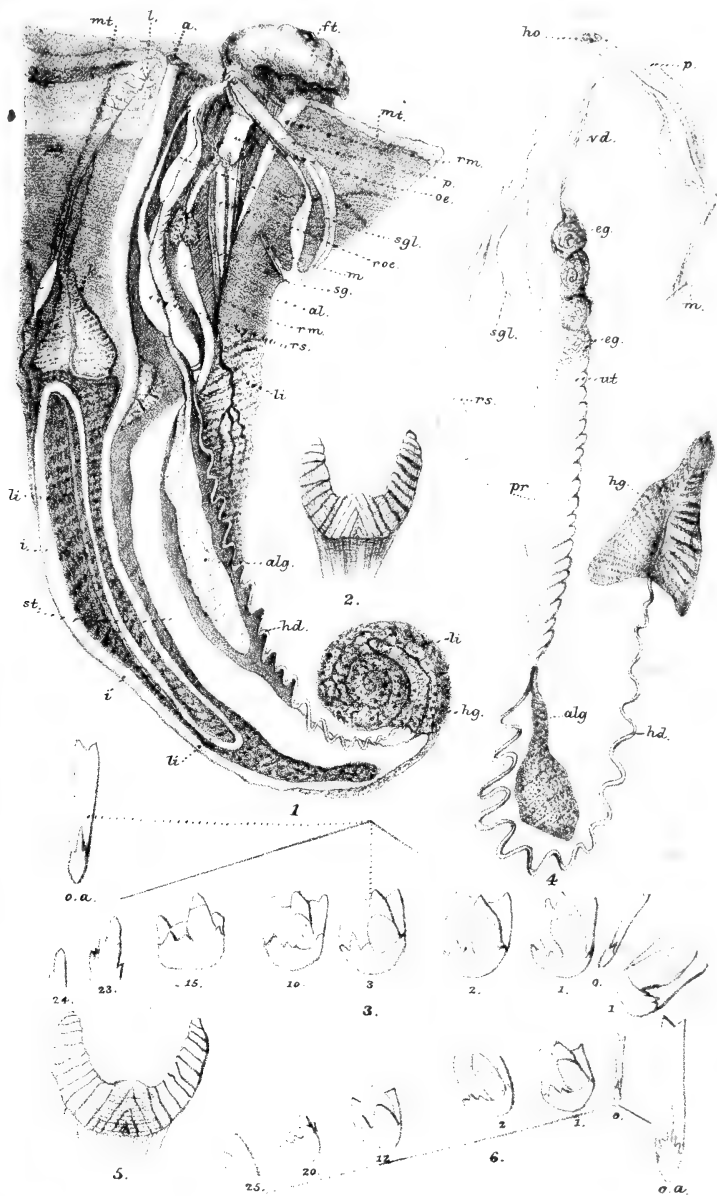
Figs. 1—3. *Plectopylis achatina*, Gray, p. 217 et seq.

1, general anatomy; 2, jaw; 3, different teeth of one transverse series.

Figs. 4—6. *Plect. cyclaspis*, Benson, p. 217 et seq.

4, genital organs; 5, jaw; 6, various teeth of a series.

*ft.*, foot; *a*, anus; *l*, lungs; *mt*, mantle; *rm*, retractile muscle of the foot; *p*, penis; *oe*, oral parts; *sg*, salivary glands; *roe*, retractor of the oral parts; *m*, retractor of the penis; *sgl*, supposed arrow gland; *al*, alimentary canal; *rs*, seminal receptacle; *li*, liver; *alg*, albuminous gland; *hd*, hermaphrodite duct; *hg*, hermapt. gland; *i*, intestines; *st*, stomach; *k*, kidney; *h*, heart; *pg*, pigment gland; *vd*, vas deferens; *ut*, uterus; *eg*, eggs in the uterus; *pr*, prostata, *ho*, hermaphrodite opening.





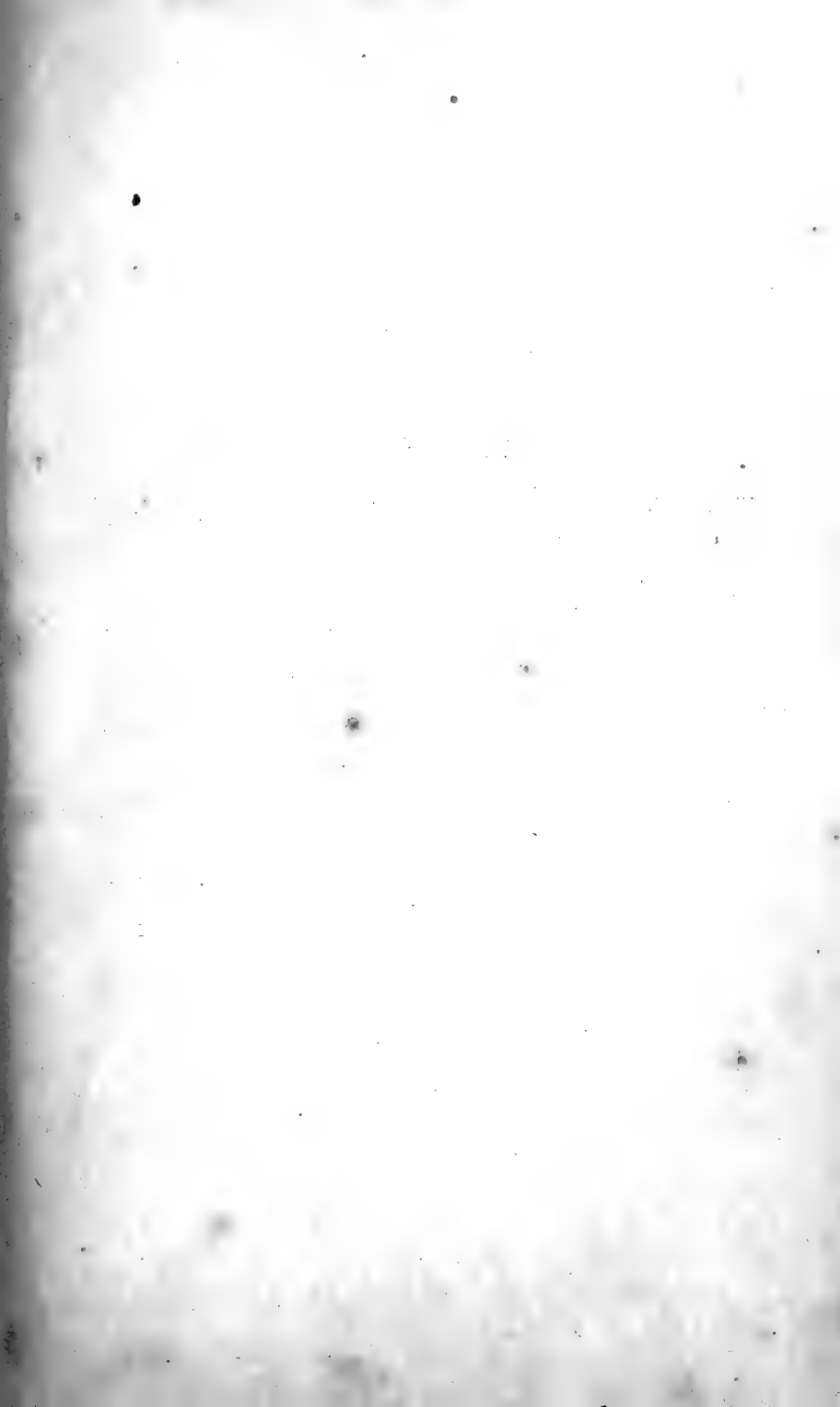


PLATE XVI.

Figs. 1—3. *Trachia delibrata*, Benson, p. 225.

1, genital organs ; 2, jaw ; 3, various teeth of one transverse series.

Figs. 4—10. *Sesara infrendens*, Gould, p. 242 et seq.

4, genital organs of a young specimen ; 5, the same of a full grown specimen ; 6, horny organ situated in an appendage of the oviduct, enlarged ten times the natural size ; 7, a transparent, horny, bearded thread, connected with the appendage represented in fig. 6 ; 8, similar threads, as seen in fig. 7, but not bearded ; 9, jaw ; 10, different teeth of one transverse row.

*ho*, hermaphrodite opening ; *p*, penis ; *m*, retractor muscle ; *ut*, uterus ; *rs*, seminal receptacle ; *hd*, hermaph. duct ; *alg*, albuminous gland ; *vd*, seminal duct ; *c*, calciferous sac ; *f*, flagellum ; *u* upper and *u'*, lower end of the peculiar horny appendage of the oviduct ; *n*, place where the end of the horny appendage was originally situated.









## PLATE XVII.

Figs. 1—5. *Rotula anceps*, Gould, see p. 233 et seq.

1. General anatomy, 2, diagrammatic view of the various lobes of the mantle, enlarged; 3, genital organs; 4, jaw; 5, teeth, all enlarged (see p. 236).

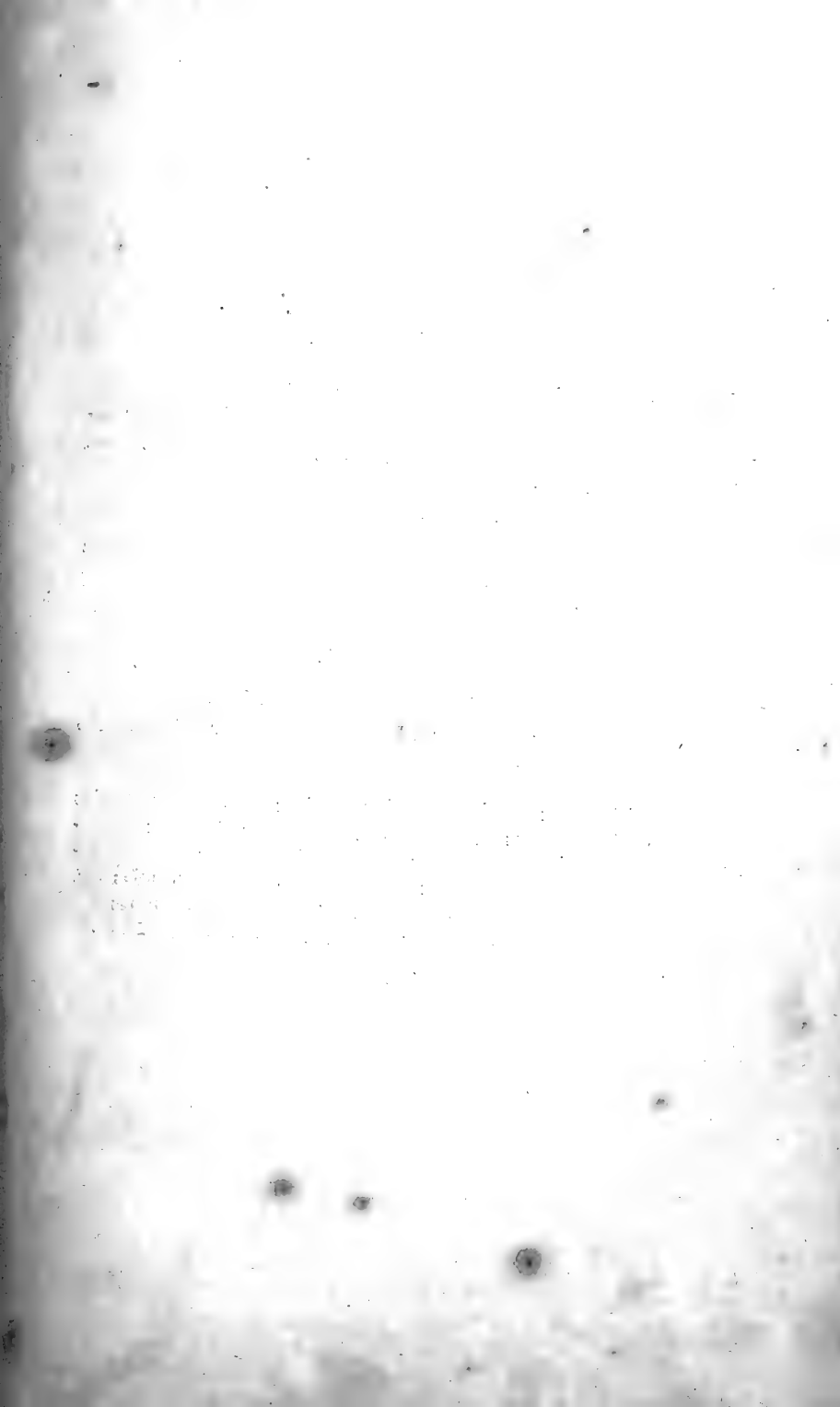
Figs. 6—14. *Macrochlamys* [*Durgella*] *honesta*, Gould, p. 248 et seq.

6, normal form; 7, Pegu variety; 8, abnormal variety from Moulmein, (comp. p. 248); 9, variety from near Moulmein; 10, jaw; 11, peculiar solid, horny threads from the genital organs; 12, solid particles out of the bag marked *x* in fig. 13, which is a peculiar appendage of the genital organs; 14, various teeth; all objects represented in figures 10—14 are greatly enlarged.

*f*, foot; *fg*, foot gland; *a*, anus; *r*, rectum; *ag*, amatorial gland; *al*, albuminous gland accompanying the rectum; *li*, liver; *i*, intestines; *st*, stomach; *sg*, salivary glands; *h*, heart; *k*, kidney; *pg*, pigment gland; *l*, lungs; *oe*, oral parts; *lsl*, left shell lobe of mantle; *lsl'*, lower end of the same; *rsl*, right shell lobe; *rsl'*, lower end of the same; *rdl*, right dorsal lobe; *ldl*, left dorsal lobe; *p*, penis; *p'*, enlarged portion of the same; *cd*, calciferous gland; *fl*, flagellum; *vd*, vas deferens; *fa*, sessile gland of the oviduct; *rs*, receptaculum seminis; *ut*, uterus; *pr*, prostata; *hd*, hermaphrodite duct; *hg*, hermaphrodite gland; *alg*, albuminous gland; *m*, retractile muscle; *ho*, hermaphrodite opening.







## PLATE XVIII.

Fig. 1—4. *Conulema attegia*, Benson, p. 237.

1, genital organs; 1a, section of the amatorial gland; 2, diagrammatic view of the mantle lobes; 3, jaw; 4, different teeth of one transverse series.

Figs. 5—9. *Conulema infula*, Benson, p. 239.

5, side view of an animal, from Calcutta; 6, genital organs during the winter season; 7, anterior portion of the same during the rainy season; 8, jaw; 9 various teeth of one transverse series.

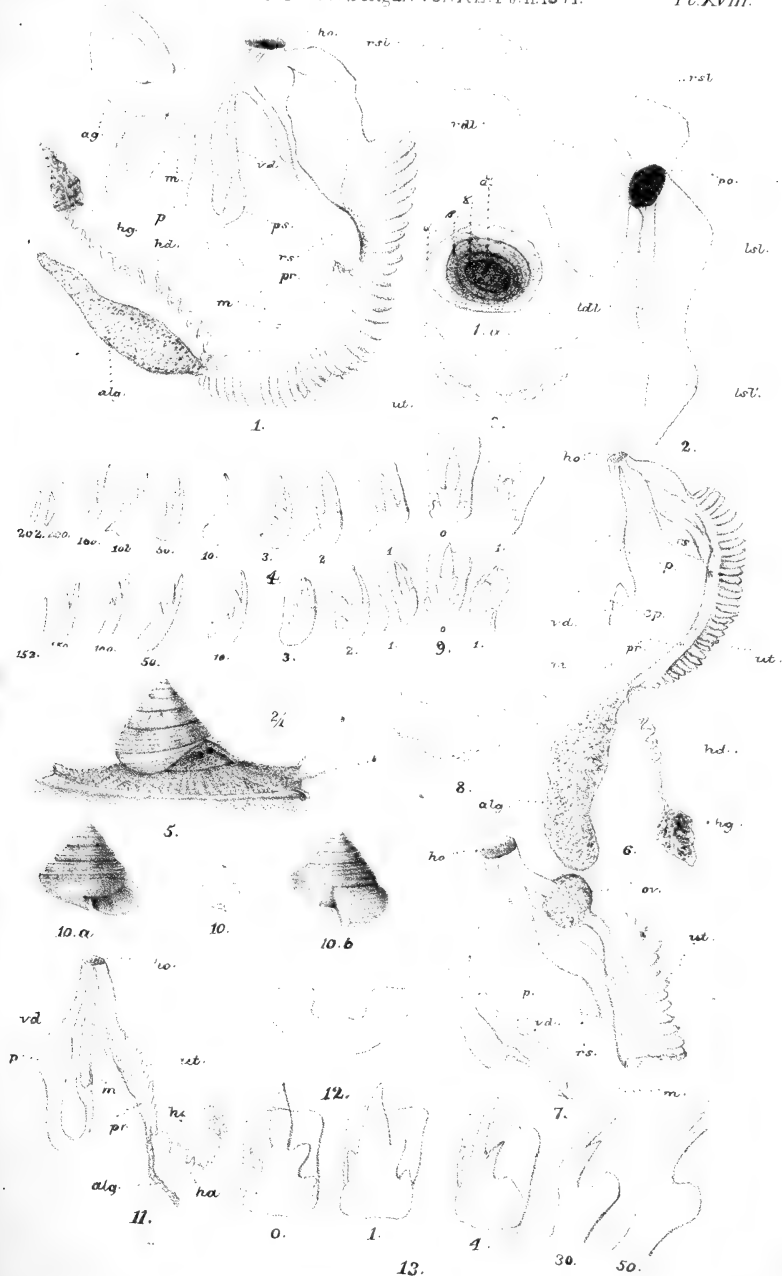
Fig. 10, *Conulema liricineta*, Stol., p. 241.

Figs. 11—13. *Microcystis molecula*, Benson, p. 251.

11, genital organs; 12, jaw; 13, a few teeth from a transverse series.

*ag*, amatorial gland; *ho*, hermaphrodite opening; *m*, retractor muscle; *p*, penis; *ps*, calciferous sac; *vd*, vas deferens; *pr*, prostata; *ut*, uterus; *hd*, hermaphrodite duct; *hg*, heramph. gland; *alg*, abbuminous gland; *rs*, receptaculum seminis; *ov*, enlarged ovary sac; *rs_l*, right shell lobe of the mantle; *rs_l'*, lower end of the same; *ls_l*, left shell lobe; *ls_l'*, lower end of the same; *rd_l*, right dorsal lobe; *ld_l*, left dorsal lobe;  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ , successive layers in the section of the amatorial gland, (fig. 1a).









## PLATE XIX.

Figs. 1—4 and 7—9. *Sophina calias*, Benson, p. 255.

1, general anatomy; 2, genital organs; 3, 3a, jaws; 4, a few teeth of a transverse series, the 5th and 14th tooth shewn in a lateral view; 7, typical specimen, front, side and upper views; 8, var. *schistostelis*, same views; 9, a specimen with irregularly thickened peristome.

Fig. 10. *Sophina forabilis*, Benson, p. 257.

10a, the front view, is enlarged twice the natural size.

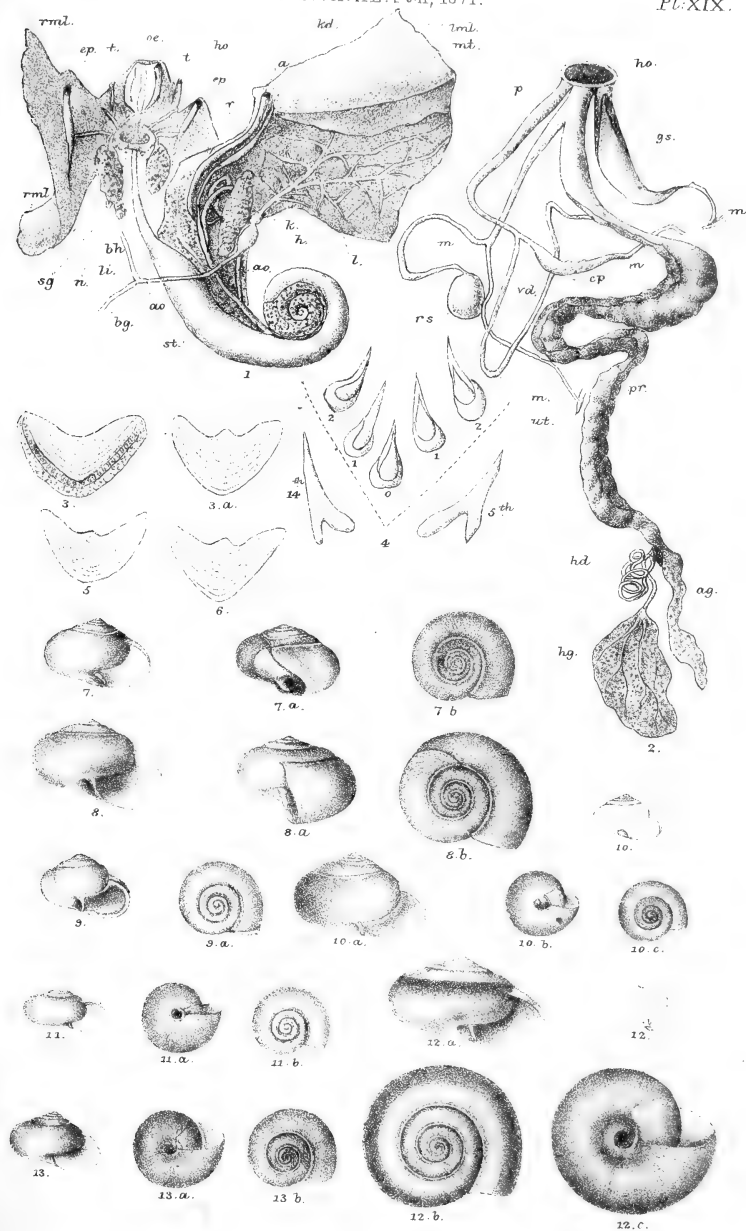
Figs. 5, 11, 12, *Sophina discoidalis*, Stol., p. 258.

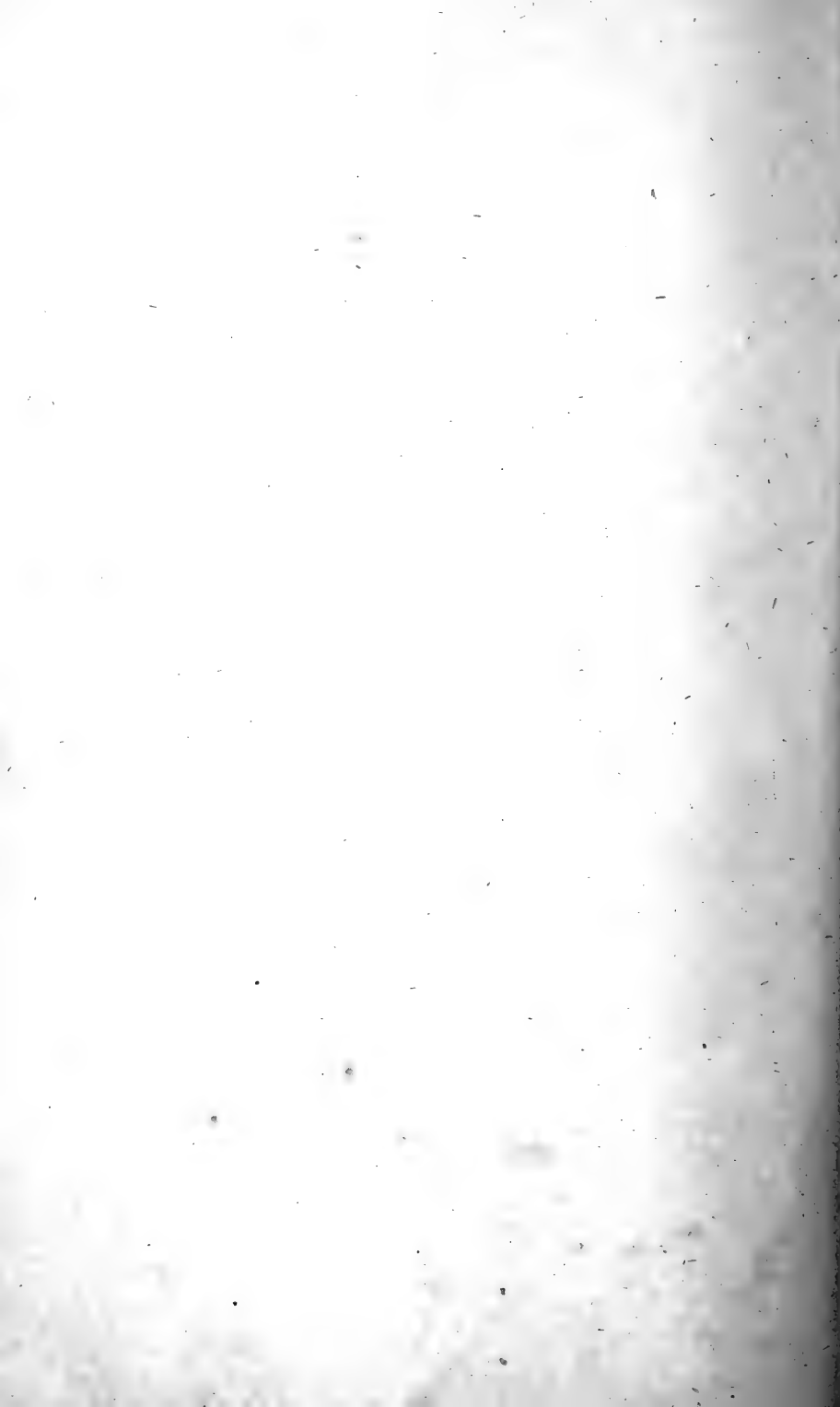
5, jaw; 11, a much depressed specimen, natural size; 12, a somewhat elevated specimen; figs. 12a, 12b, 12c, are enlarged.

Figs. 6 and 13. *Sophina conjungens*, Stol., p. 259.

6, jaw; 13, different views in natural size.

oe, oral parts; *t*, tentacles; *ep*, eye-pedicles; *a*, anus; *kd*, kidney duct; *mt*, mantle; *lml*, left shell lobe; *rml*, right shell lobe; *sg*, salivary glands; *n*, ganglion; *ao*, aorta with the branches *lh* and *bg*; *st*, stomach; *k*, kidney; *h*, heart; *l*, lungs; *r*, rectum; *m*, retractor; *cp*, calciferous sac; *vd*, seminal duct; *rs*, seminal receptacle; *p*, penis; *gs*, amatorial gland; *ho*, hermaphrodite opening; *pr*, prostata; *ut*, uterus; *hd*, hermaphrodite duct; *hg*, hermaphrodite gland; *ag*, albuminous gland.





Recently Major Beddome has found both land shells and reptiles with unmistakeable Malabar affinities on the Golconda hills near Vizagapatam and Mahendragiri hill near Ganjam. On a former occasion, J. A. S. B., 1867, p. 199, I called attention to the peculiar isolation of *Rucervus Duvaucelli*, (the Barasingha deer,) *Gallus ferrugineus* and the Sáltree (*Shorea robusta*) just below Pachmari in the Denwa valley, but this is a case of an outlier of the Bengal fauna, not of that inhabiting Malabar. Mr. Hume (Scrap Book, I, p. 297,) records the occurrence of *Spizaetus Nipalensis* on the Pachmari hills, and (J. A. S. B., 1870, p. 117,) of *Otocompsa fuscicaudata* on Mount Abú, and I have little doubt but that other Himalayan or Malabar forms accompany them.

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NOTES ON TERRESTRIAL MOLLUSCA FROM THE NEIGHBOURHOOD OF MOULMEIN, (TENASSERIM PROVINCES), WITH DESCRIPTIONS OF NEW SPECIES,—by DR. F. STOLICZKA.

(With plates XV—XIX.)

[Continued from p. 177.]

Fam. **Helicidæ.**

This family includes the stylommatophorous (stalk-eyed) species usually called *Helix*, and which do not possess a mucous gland at the upper termination of the foot. The jaws are usually ribbed, and the teeth shorter, and stouter, than in the ZONITIDÆ. I shall note two genera, *Plectopylis* and *Trachia*.

Genus. **PLECTOPYLIS**, Bens.

(See pl. xv, and its explanation.)

This name was proposed as a sub-genus of *Helix* in Ann. Mag. N. H., 3rd ser., vol. v, p. 244. Benson gave a description of the animal of *Pl. achatina*, (Ann. and Mag. N. H., 3rd ser., iv, p. 95), and pointed out (ibidem, vol. vi, p. 98) the characteristic differences of the shells, referred by him to *Plectopylis*, as compared with *Corilla*, (*Atopa* of Albers, *C. Rivolii* and others). The anatomy of the animal of *Plectopylis* indicates a good generic distinction from allied forms. I cannot, however, say how far the peculiarities, to which I shall presently refer, agree with the Ceylonese *Corilla*, but a

comparison of the two will no doubt prove interesting, and establish more firmly the relations of the present genus to *Corilla*, *Ophiogyra*, and the American *Polygyra*.

The Indian and Burmese species referable to *Plectopylis* are: *P. achatina*, Gray, *P. anguina*, *refuga* and *repercussa*, Gould, *cyclaspis*, *brachyplecta*, *plectostoma*, *leiophis*, *pinacis*, Bens., *Karenorum*, *peracta*, *Andersoni* and *macromphalus*, Blf., a new species allied to the last from the Khasi hills, and probably also *Helix retifera*, Pfr., another species from Ceylon, and also *H. pettos** of Martens, apparently closely allied to *Pl. pinacis*. All the species characterize the Malay fauna; none of them occurs westward of Sikkim, and their geographical distribution extends from this part of the Himalayas, in a south-easterly direction through Assam, the Khasi and Tippera hills into Burma, Tavoy and the Southern Malay country. Only the last mentioned species is found on the Nilgiri hills, its form represents a slightly different type, the umbilicus being comparatively narrower than in any other *Plectopylis*, and the margins of the aperture are barely expanded; within there is only a transverse ridge on one side projecting between two pairs of tubercles on the other; no longitudinal ribs are present. I fully expect that, when the animal of *H. retifera* becomes known, it will probably exhibit somewhat different characters from those of the present genus.

The shells of *Plectopylis* are characterized by a planorboid, umbilicated form, somewhat expanded and usually thickened peristome, and by the presence of one or two transverse, and a few spiral ridges placed internally some distance from the aperture. I consider these internal folds to be in some respect analogous to the clausilium in *Clausilia*, the animals of the two genera being also somewhat similar in external characters. When the animal of *Plectopylis* retracts into its shell, the passage through the folds is generally found to be filled up with mucous secretion, but the body itself mostly retracts one half of a whorl further inwards. During hibernation the aperture is besides closed with the usual calcareous lamina, as in other HELICIDÆ.

I have examined the animals of *Pl. achatina*, *cyclaspis*, *pinacis*, and *macromphalus*. They are all very similar in external shape

* Malacozool. Blætter, xv, p. 158.



and organization. I will for the present note only the two first named species which occur near Moulmein.

In both the foot is rather short, rarely equalling in length the greater diameter of the shell, depressed, truncate in front, narrowly rounded or sometimes obtusely pointed posteriorly, covered with warts and granules; lateral line very slightly indicated, or not at all developed; body cylindrical, short, covered with rather strong warts; pedicles of moderate length, slightly thickened at the end, and with the eyes small, placed centrally or very nearly so; tentacles always very short. On the whole the form of the body very closely resembles that of a *Clausilia*, and a comparison of the internal organisation of the two genera also indicates their close relation.

The mantle margin is entire, thickened towards the end, but the edge itself is again thinner; pulmonary lobes simple without any appendages, the right larger than the left; pulmonary cavity very small, posteriorly closed up by a very thin lamina. The digestive organs are distinguished by the small size of the oral parts, great length of the stomach and of the intestines, which make a long double twist, but have no cæca or other appendages. The salivary glands are comparatively small. The liver very extensive and of a peculiar coarsely tubular, clustered appearance. The kidney is large, of triangular shape, and has a special duct at the anterior end; it terminates in the pulmonary cavity. Along the aorta there is either on the right, or on both sides, a linear gland of dark pigment (*pg*), its quantity, however, varying greatly in different specimens.

The genital organs are rather simple. The female part has two appendages: one longer which is the so-called *receptaculum seminis*, but in which I only found a light brown colouring matter intermixed with flat irregular particles, and a shorter, more muscular gland which appears to represent the arrow or amatorial gland. The uterus is thin, the hermaphrodite duct very long, and the hermaphrodite gland situated behind at the posterior end of the stomach. The vas deferens, or seminal duct, is short and thickened before it passes into the penis, which is attached by a strong muscle to the right median side of the mantle, but has no external appendages.

All the species which I examined are ovo-viviparous, as already noticed by Benson in *P. achatina*. One specimen of *P. cyclaspis* had three well developed embryos, each consisting of three convolutions, regularly coiled in and enclosed in a thin soft sac of calcareous granules, loosely jointed together. A specimen of *P. pinacis* had the whole uterus filled with 13 eggs, in different stages of development. The first were perfectly developed, composed of  $2\frac{1}{2}$  whorls, distinctly discernible. The youngest only consisted of a yolk mass, darker internally than externally and folded on itself hemispherically, like an enrolled *Oniscus*.

The jaw is very thin, horny, semi-elliptical, with a small anterior median projection; it is marked transversely with a great number of more or less distant grooves which divaricate in the centre. The surface often besides shews in a transparent light a very fine concentric striation, either on the entire jaw, or only on its median portion.

The radula is long and of moderate width, composed of numerous (about 100, or slightly more) transverse, more or less angular rows, each containing between 60 and 70 teeth. The centre tooth is in *achatina* and *cyclaspis* very small, long, recurved and pointed at the end. The lateral teeth, which gradually decrease in size towards the outer margins, are of a subquadrangular shape; each possess a long rather obtuse, robust cusp, and besides that on the outer side an inflected margin with 2 or 3 small cusps, and on the inner a marginal cusp. The outermost teeth become quite simple in shape, only one or two of the outer denticles being indicated. On the last rows of the radula, the teeth have generally only the robust cusps developed.

On comparing the jaw of *Plectopylis* with that of *Clausilia*, it will be seen that both are similar in structure, but the shape is different and the transverse sulcations are only indicated in the latter genus. Much greater is the similarity of the *Plectopylis* jaw with that of *Cylindrella*, as published by Crosse and Fischer in Journ. de Conch., vol. x, 1870, p. 5, &c., pl. iii and iv, with the exception that the median projection is wanting in the *Cylindrella* jaw.

The arrangement of the teeth of *P. achatina* and *cyclaspis* also agrees with that of *Cylindrella* in the very small size of the centre

tooth, but this is not a constant character. In *P. pinacis*, the centre tooth is larger and more of a shape similar to that of the lateral teeth, which, however, in all the species retain distinctly the helicoid character.

PLECTOPYLIS ACHATINA, Gray, pl. xv, figs. 1—3.

*Helix achatina*, Gray apud Pfeiffer, Chem., &c. Hanley and Theob., Conch. Indica, pl. xiii, fig. 1.*

The two embryonal whorls are generally somewhat tumescent, very finely punctated or scrobiculate, and of a pale yellowish or whitish colour; the third whorl is pale rufescent with the striæ of growth distinct, in addition to which on the fourth whorl a spiral striation appears, but it soon again becomes obsolete, while the striæ of growth continue to be well marked.

Young shells are surrounded on the last whorl with three fringes of hairy cuticle, above and below, and near the centre of the whorl, which is conspicuously angular. The basal fringe at first, disappears, then the median, and at last the upper one.

The plication is one-third of the circuit of the last whorl distant from the aperture. It consists on the inner lip of one oblique transverse lamina, emitting at the base one short anterior fold, another near the middle, extending up to the centre of the inner peristome, at the upper end it is posteriorly bipartite, the lower branch bending downwards across the inner lip and terminating with a short rib directed backwards. At the base of the inner lip there is besides a separate very thin rib which becomes obsolete before it reaches the lower angle of the mouth. The outer lip has above three longitudinal ribs, the innermost of which is thinnest and the median posteriorly generally somewhat irregularly flexuous and bifurcate, a large transverse lamina projects into the triangular space formed by the inner lamina, and has a thin longitudinal rib below it.

This species is extremely common on all the limestone hills about Moulmein. Among thousands of specimens not one dextrorse variety was met with. The largest specimens I have seen mea-

* A very inadequate figure of the species. The last whorl is unnecessarily angular, the umbilicus too small, and the short fold at the basal angle of the aperture far too strong.

sured in the longer diameter 35 mm., but specimens of half the size, and even smaller than that, often have all the appearance of being full grown. The amount to which the aperture is deflected varies, but I never saw a specimen in which it was entirely turned downwards, as shewn in Küster's figure.

The usual colour is rufous brown above, albescent below, with the mouth deep or pale lilac about the peristome. In caves, secluded shady localities, and under large stones, white or yellowish white specimens are often found, the peristome being in this case also white. The colour of the animal varies as much as that of the shell; it is rarely white, more often grey or brownish black; in the former case the head, pedicles and tentacles and the foot in front are grey, in the latter these organs are only somewhat paler than the general dark coloration of the body.

PLECTOPYLIS CYCLASPIS, Bens., pl. xv, figs. 4—6.

*Helix cyclaspis*, Benson, vide Pfeiff. Mon. Hel., v, 414.—Hanley and Theob., Conch. Indica, pl. xiii, fig. 10.*

When the shells are well preserved and perfectly fresh they possess a coarsely serrated fringe of horny cuticle at the periphery of the last whorl; this fringe is, however, very easily worn off in older shells even during life. The two embryonal whorls are almost always yellowish albescent, the third is uniform brown, and the following become marbled and banded with white and brown. The spiral striation round the umbilicus, particularly alluded to in Benson's description of the species barely deserves the name; it is generally very indistinct and caused by the attachment of the fine hairs of the cuticle, this being there a little more strongly developed than on the rest of the lower surface, but the rugosity generally is hardly more apparent than on the upper side of the shell.

The internal plication is situated at a distance from the aperture of one-third of the last circuit. It consists on the inner lip of a large, transversely oblique, erect lamella, on the inner end produced into an anterior short fold; on the outer, or peripheral, side it is divided posteriorly into two folds, the outer of which

* An entirely insufficient illustration of the species;

is thin and extends directly backwards, while the inner proceeds obliquely across the lip, meeting a thin longitudinal rib, which runs on the inner side of the largest lamina, so as to include a kind of a triangular space. In this space there projects from the basal side of the whorl a large oblique transverse lamina, accompanied on either side by a thin longitudinal rib. Two thin ribs are situated on the upper side of the whorl between the suture and the peripheral keel. The median rib which originates near the edge of the inner lip of the aperture extends only for a short distance internally. The plication, as above described, was observed to be constant in 8 specimens of various sizes.

Judging from the description of Pfeiffer's *H. revoluta* (Mon. Hel., v, 416) I can hardly think that the shell referred to can be distinct from *cyclaspis*. I have specimens of this last which perfectly agree with the measurements given by Pfeiffer of his *revoluta*, and said to be from the Andamans. I never received *cyclaspis* amongst many thousands of shells from those islands, and I doubt its occurrence there quite as much as that of *P. achatina*, recorded by Tryon, (comp. Proc. Asiat. Soc., March, 1870, p. 88). The shell fauna of the Andamans and Nicobars shews considerable relations to that of Arracan, but barely any to that of the limestone hills about Moulmein. The latter is, as already stated, quite peculiar, and very distinct from the fauna of the adjoining low lands, and even from that of the neighbouring sandstone hills.

*P. cyclaspis* is found sparingly on all the limestone hills about Moulmein. The animal is very shy, usually living in crevices and holes, and closely adhering to the rock even when moving about. It is uniform dark grey or blackish with a pink tinge, paler on the pedicles and tentacles, the latter being very small and situated quite at the base of the mouth; the warts of the body are black and rather large.

#### *Genus.* TRACHIA, Albers.

(See pl. xvi, figs. 1—3, and the accompanying explanation.)

This genus was proposed by Albers for *H. asperella*, Pfr., as type. It is characterised by a planorboid shape, moderately thin semi-transparent structure of the shell, covered with a setaceous cuticle, by

an expanded outer peristome and by usually possessing a spacious umbilicus. Albers places in the genus also *H. Tuckeri*, Pfr., *fallaciosa*, Pfr., *uginosa*, Fér., and *nilagirica*, Pfr. Of these only the first is probably referable to the genus, the others I would prefer classifying in *Planospira*, considering *nilagirica* as the most aberrant form. Mr. W. T. Blanford (Ann. Mag. N. H., 1863, 3rd ser., vol. xi, p. 85) added to the genus* *H. delibrata*, Bens., *gabata*, Gould, (= *Merguensis*, Pfr.), *Helferi*, Bens., *vittata*† Mill., *proxima*, Fér., and *crassicostata*, Pfr. The three last named species have, I believe, again to be referred to *Planospira*, but the three others participate of the generic characters of *asperella* and must, therefore, be considered as belonging to *Trachia*. I could quote a few other species, as for instance *H. squalus*, Hinds, *H. mendax*, Martens, and others, but they do not strictly speaking belong to the Indo-Burmese fauna.

*Planospira* of Beck differs from *Trachia* by the solidity of the shell, thickened inner lip, &c. *Campylæa* is, however, much more closely allied to *Trachia*, both in form and structure of the shell; indeed there are strictly speaking no external characters to distinguish the two. But the former, with its type *H. cingulata*, is said to possess a 4—6 ribbed jaw, and the genital organs have numerous appendages, while in *H. delibrata*, (the only species of *Trachia* of which I have examined the animal), the jaw has a great number of ribs and the genital organs are of a very simple form. Should, however, these characters prove to be of no avail for purposes of classification, the two genera must be united into one, and this is by no means improbable.

The structure of the shell of *Trachia* also exhibits considerable relation to some of the species of *Dorcasia*, and *Fruticicola*, the latter apparently represented in India by the *Helix similis* group. I have examined some animals of this species from Penang, and I find that the dentition agrees, but the jaw and genital organs are different from those of *Trachia*; the former being generally costate, and the latter with a thick amatorial gland.

It is difficult to predict in the present stage of our knowledge of the animals what extent should be given to the genera *Dorcasia*

* Quoted by a misprint as '*Tachia*.'

† I agree with Mr. Blanford that there is no need of proposing a new genus for this species, as has been done by Albers.

and *Fruticicola*, if *H. similaris* and *bolus*, and others, are to be considered as belonging to the latter. These species evidently pass gradually through *H. tapeina*, Bs., *Huttoni*, Pfr., *H. Oldhami*, Bs., to the more acutely carinated species, as *Osbecki*, Phil., *trichotropis* and *elegantissima*, Pfr., for the last of which Albers proposed the name *Plectotropis*. *H. gabata* was incorrectly referred by Albers to the latter genus, while the closely allied species, *H. delibrata*, is referred by him to *Planospira*. Albers places *H. rotatoria* in his new genus *Discus*, (a name which cannot be used), and refers it to the ZONITIDÆ. The type of his *Discus* is *H. Metcalfi*, Pfr., which is most likely a *Trochomorpha*, a genus to be placed at the end of the ZONITIDÆ, being in many respects intermediate between this family and the HELICIDÆ. Mr. Blanford's *Sivella*, proposed for *H. castra*, Bens., is also to be united with *Trochomorpha*. The animal has an undivided sole to the foot, but a very faint mucous groove at its upper posterior end.

*H. Huttoni* is found in Albers' list among the *Rotulæ*, and there are a great number of other similar misplacements in that author's lists regarding the Indian and Malayan HELICEA; some of the more evident mistakes have already been pointed out by Mr. W. T. Blanford in his numerous conchological papers.

TRACHIA DELIBRATA, Bens., pl. xvi, figs. 1—3.

*Helix delibrata*, Benson, Journ. A. S. Bengal, 1836, vol. v, p. 352; *eadem* Pfeiff, Chem., Phil., Reeve, &c. Hanley and Theob., Conch. Indica, pl. xiv, fig. 4, (*H. gabata*), and figs. 9—10.

The form described from Tavoy by Gould as *H. procumbens* (Bost. J., 1844, vol. iv, p. 453, pl. xxiv, fig 1), represents a peculiar variety, which is figured by Reeve, while Chemnitz' figure is most probably taken from a Khasi hill specimen. The Tavoy form which also occurs at Moulmein, (though rather rarely), has the whorls rapidly increasing, the spire flat or very little elevated, the last whorl considerably descending and the inner lip very narrow, giving, so to say, a trumpet shape to the aperture. The usual size is 18—20 m.m. The surface is covered with a pale olivaceous or brownish cuticle, distinctly hairy in young specimens, but becoming almost perfectly smooth and shining in older ones;

at the upper periphery of the last whorl there is usually a single brown band traceable. Specimens devoid of the cuticle appear white; one of this kind was figured by Hanley and Theobald under the name *H. gabata*, as already alluded to.

Specimens from Pegu and Upper Burma, perfectly agree with those from Moulmein, except that the aperture is generally a little less deflexed. Large specimens, measuring in the longer diameter more than 20 m.m., often become very flat.

Specimens from Assam (Tézpore) have the whorls more regularly increasing, than Burmese specimens, they possess, therefore, a more orbicular shape, and the upper side is conspicuously convex. The cuticle becomes quite smooth with advanced age, and the shells are often encircled with numerous broader and narrower reddish brown bands. Full grown specimens (22—25 m.m.) from the Khasi hills and from Darjeeling appear to be peculiarly thin, and when well preserved they have the cuticle very rough and hairy; they are also generally marked with numerous brownish bands. In all specimens from the three last named localities the aperture is much less deflected and the inner lip longer, than in those from Tenasserim and Pegu, thus giving the shell apparently a very different aspect from the southern *procumbens*, but the gradual change from one form into the other, as well as the variations to be noticed in one and the same locality, clearly shew that all belong to one and the same species; at least there is not one constant character by which they could be separated. The following measurements exhibit the amount of variation.

	Moulmein.	Pegu.	Assam.		Khasi hills.	Darjeeling.
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
Larger diam. (including expansion of lip), .....	18·5	23·0	18·0—18·5		23·0	21·5
Width of last whorl near the aperture, ..	6·5	7·8	6·6—5·5		8·0	8·0
Smaller diameter, .....	14·0	18·3	14·3—15·2		17·7	16·5
Height of shell, .....	9·3	10·2	9·0—10·0		9·3	9·5
" of aperture, .....	7·4	9·5	8·2—8·5		8·5	8·5
Width, .....	9·3	12·0	9·8—9·0		11·5	11·0
Smaller diam. : larger diam.	0·75	0·79	0·79—0·82		0·79	0·76
Height of aperture : width, ...	0·79	0·79	0·83—0·94		0·74	0·77

*procum- procum-  
bens, bens,*

*delibrata.*

*a* typical; *b*, approaching the type.



The two last items in the table, giving the relative proportions of the most important characters upon which the growth of the shell depends, clearly shew the identity of the species. Two forms geographically most distant, from Moulmein and Darjeeling, very closely correspond with each other. The limits of variation in the proportions between the smaller and the larger diameters are 0.75 and 0.82, and those of the height to width of the aperture 0.74 to 0.94, the difference being chiefly due to the greater or lesser expansion of the peristome.

The animal of the Moulmein variety is fleshy grey, anteriorly much longer than posteriorly; foot depressed, finely granulated like the rest of the body, without a lateral line; pedicles long, tentacles moderate, both of a darker grey colour; a pale strip runs from between the pedicles along the centre of the back and gradually disappears posteriorly.

The mantle is entire at its edge and very slightly thickened, internally spotted with dusky brown; the left dorsal lobe is only represented by a simple thickening, the right reaches anteriorly over the back and becomes rapidly narrower below. The mouth is short, thick, as in other *HELICIDÆ*; the salivary glands very large, enveloping the whole of the anterior part of the alimentary canal. The intestines are of considerable length, making one shorter and one longer twist. Other parts of the digestive and secretory systems do not differ from those of other *HELICIDÆ*; but the genital organs are peculiar. The uterus is thin and long; the seminal receptacle almost equal to it in length, and only moderately thickened towards its obtuse end. No glands at the anterior end of the uterus, nor an appendage on the recept. seminis; neither was an arrow gland observed. The penis is, however, very long, twisted, with a small cœcum (? flagellum) at the point where the vas deferens enters; the last thickened part is suspended by a special retractile muscle.

The jaw is moderately narrow, semilunar, ribbed on the entire surface, the 7 median ribs being stronger than those following at the sides.

The radula is of very great length. I counted 124 transverse, slightly angular series of teeth. The median tooth is very little

smaller than the adjoining; it is obtusely pointed, with a small emargination on either side. The following teeth are gradually more oblique, but the base retains its subquadrangular shape; the inner large hook decreases and the outer small pointed one increases in size, until they become nearly equal. The one or two outermost teeth appear to be shortly tricuspid. The basal portion of the teeth is in all elongately subquadrangular, above very slightly emarginate on the central tooth, but becoming gradually more so on the laterals, while at the same time the width slightly and the length considerably decrease, until on the last teeth the upper ends are very distinctly bifurcate. The formula of the teeth is  $22 \text{ (to } 18) + 20 - 1 - 20 + (18 \text{ to } 22)$ , there being 77 to 88 teeth in each transverse series. The first 20 teeth on either side of the central tooth are somewhat larger than the following, but the passage from the larger to the smaller ones is very gradual, and not always distinctly traceable.

#### TRACHIA GABATA, Gould.

*Helix gabata*, Gould, 1844, Bost. Journ., vol. iv, p. 454, pl. xxiv, fig. 9;—*eadem* Chem., Pfeiff., Reeve, &c.

Hanley and Theob., Conch. Indica, pl. xiv, fig. 7, non *H. gabata*, *ibidem* fig. 4 = *H. procumbens*, Gould.

*H. Merquiensis*, Phil., 1846; *eadem* Pfeiffer, et auctorum.

*Plectotropis gabata*, apud Wall., Proc. Z. Soc., 1865, p. 408.

The specific distinctions pointed out by Philippi between his *Merquiensis* and Gould's *gabata*, and relied on by subsequent authors, do not exist in reality. Both forms are covered with a hairy cuticle, but, when the hairs are broken off, a finely granular, or rather punctate or scrobiculate, surface is produced, which generally can be easily detected, if not on the whole, at least on some portions, of the shell. Rarely are the hairs so much worn down, that the surface attains the appearance of being quite smooth.

Shells which have the upper side quite flat, resembling the one figured by Gould, would seem to be of extreme rarity. I have not seen any full grown ones equal to it, but specimens with a slight upper convexity, like those delineated by Chemnitz and Reeve, are of common occurrence. The upper convexity of the shell is indeed subject to considerable variation. Some specimens have

the whorls above so very tumid, that the peripheral keel on the last whorl instead of being near the upper edge comes to be situated nearly in the middle of the whorl. The aperture is more or less deflected, of a transverse, elongately oval, shape, with the inner lip generally conspicuously thickened and slightly emarginated.

The species was originally described from Tavoy. It is not uncommon about Moulmein on the limestone hills at Damotha and eastward on the Gayín river, but I have not obtained a living specimen of it. Major Godwin-Austen collected it also in the North Cachar hills. Wallace quotes it (doubtfully) from Celebes, but Martens, (*Preusis. Exped.*, p. 391) seems to question the correctness of the locality.

Hanley and Theobald, in their *Conch. Indica*, give a rather poor figure of *Merquiensis*, but what is figured as *gabata*, Gould, appears to me to represent a shell of exactly the same type as Gould's *procumbens* which is identical with Benson's *delibrata*.

#### *Fam. ZONITIDÆ.*

The animals of this family are characterized by the invariable presence of a mucous gland, situated at the truncate, posterior end of the foot; above the base of the sole runs a distinct lateral line, or a row of enlarged tubercles, between the gland and the mouth; the jaw is smooth, or finely concentrically striated; outer teeth of the radula slender and generally bicuspid at the end, except the very last ones which are often simple, styli-form.

In the muscular, digestive and nervous systems the ZONITIDÆ do not differ from the HELICIDÆ, but there is usually a slight difference to be observed in the reproductive organs. In the latter family the so-called arrow or amatorial sac* (*glandula mucosa cum sagitta amatoria*) is short, with numerous thin appendages; in the former it is either simple, or sometimes altogether absent. If present, it appears to be an important organ during copulation. It is generally of a cylindrical shape and of a tough, muscular structure, attached by a special retractile muscle, enclosed in a tubular sheath and terminating with a pointed papilla or flagel-

* Or dart-sac of some English authors.

lum. The internal cavity is often filled with hardened particles of various shapes. Although during copulation an intromissile organ, it can only be considered as an organ of irritation, while the true penis is represented by a simple enlarged tube of the terminal part of the seminal duct (vas deferens). This is mostly the case, whenever the amatorial sac with its papilla is well developed. Some most remarkable organs, apparently modifications of the amatorial sac will be noticed in the genus *Sesara* and in *Macrochlamys* [*Durgella*] *honesta*. I hope to return to this subject at some future date and give a revised list of the Indian genera belonging to the present family, but many more animals must yet be examined, before reliable materials for purposes of classification can be obtained.

For the present I shall confine my remarks to the following genera, *Rotula*, *Conulema*, *Sesara*, *Macrochlamys* with *Durgella*, *Microcystis* and *Sophina*. Of other forms of ZONITIDÆ, common about Moulmein, I have omitted *Helicarion*, having the intention of examining this genus in connection with several other allied forms from the Khasi-hills and from the Himalayas at an early date.

With reference to the organs which are useful in the grouping of the ZONITIDÆ, I would especially draw attention to some variabilities in the genital apparatus. The presence or absence of an arrow, or amatorial sac, has been considered as an important generic distinction. I have repeatedly satisfied myself, that it is not so, and moreover that references to the form and shape of the genital organs must be very cautiously made. When animals are examined, it is very important to know whether they are full grown or adolescent, or very young. In each of these cases the form of the genital organs may be very different, as will, for instance, be found noticed in the genus *Sesara*. Again the size and development of certain parts of the genital system vary greatly according to the season of the year, &c.

In speaking of the different organs in the general anatomy of the animals, I have mostly employed terms which have come into general use in anatomical publications. The arrow sac, (or dart-sac of some English authors) I have often termed amatorial sac, be-

cause it includes only an amatorial, not a true copulative, organ. When speaking of the mantle (see pl. xvii, fig 2,) I have termed, according to Semper, the two portions of the mantle, which on either side of the pulmonary opening are more or less reflected over portions of the peristome, the right and left *shell-lobes*, and those which cover the back of the animal the *dorsal-lobes*. Strictly speaking, there are only two mantle lobes present, one right and one left, but of each the superior portions often cover parts of the shell, and these are called *shell-lobes*; they besides often possess separate appendages.

The foot is below either grooved in the middle or not, but there is always a more or less wide muscular area present, which is separated from the margins of the sole by fine lines.

*Genus.* ROTULA, Albers.

This name was proposed by Albers (*Helic.*, edit. 2nd, p. 62,) for *Helix detecta*, Fer., which species represents a type of *subdiscoid* ZONITIDÆ, possessing a thin shell with numerous whorls, these being narrow, flattened and sculptured above: the last with more or less inflated, smooth, or finely striated polished base; narrowly, or not, perforated; carinated at the periphery; apertural margins simple, attenuated, sometimes internally slightly thickened. Thus characterized *Rotula* would include a large group of ZONITIDÆ from India and the adjacent islands. I may mention *serrula* and *pansa*, Bens., *indica* and *Shiplayi*, Pf., *Kundaensis*, Blf., &c. When the last whorl is more rounded, as in *ornatissima*, Bens., the form would appear to pass into Semper's *Euplecta*, and when the upper sculptured surface becomes smoother, as in *textrina*, Bens., the shells would appear to form a transition towards *Macrochlamys*.

If the external characters of the shells be alone consulted, I do not think that great difficulty can be experienced in classifying the species under this genus, and, unless disproved by the examination of the animal of the type, *R. detecta*, Fér., the genus may stand as indicated above. If this be admitted, and considering *Helix anceps* of Gould, *H. Massoni*, Behn, and another unnamed species from Penang,—of all of which I have examined live animals,—as belonging to *Rotula*, I may add the following

from the soft parts of the animal to the characteristic of the genus.

*Foot about equal in length to twice the largest diameter of the shell, moderately narrow, tail gland distinct with a small, obtuse, hook-like appendage above it; sole with two longitudinal furrows; left shell-lobe with a narrow appendage, originating some distance from the pulmonary orifice, a little below the angular periphery of the last whorl of the shell, and reflected over the basal portion of the last whorl only; right shell-lobe linguatè, above (at the posterior angle of the aperture of the shell) thickened, and below (at the columellar lip) slightly produced; left dorsal lobe divided into two lobes, the upper linguatè, the lower narrow, sometimes nearly obsolete; right dorsal lobe large, considerably extending over the neck of the animal. Jaw semilunar, of nearly equal breadth throughout, smooth; radula with many median rows of subequal teeth conspicuously larger than the outer teeth.*

It will be seen from this characteristic that I omit to make reference to the form of the genital organs for reasons which I have already explained, but further on I shall give some anatomical details of a species which, I believe, may be considered as one of the typical forms of the genus, *R. anceps*.

Semper (Reisen im Arch. der Philipp., vol. III, pt. i, p. 38) characterizes *Rotula* merely from a few anatomical characters which appear to me very insufficient for such a purpose. He considers Albers type as only doubtfully belonging to the genus, thus establishing the latter altogether upon a new basis, and placing *H. cœlatura*, Fer., *rufa*, Lesson, *Massoni*, Behn, and *Campbelli*, Gray, in it. Of these I would exclude the first named species; the form of its shell is quite different from those of the other species, and the character of ornamentation indicates that the mantle lobes, if any be present, must also be different; it besides has no appendage above the tail-gland. The three other species I take, however, to belong to *Rotula*.

*H. semicerina*, Morl., (= *Rawsonis*, Reeve) is also referable to *Rotula*; it is connected through *implicata*,* Nevill, with *H. argentea*, Reeve, and thus passes into the *Trochomorpha* type of shell, though the animal is decidedly one of the ZONITIDÆ. *H. cernica*,

* Journ. Asiat. Soc., 1870, vol. XXXIX, pl. ii, p. 407.

Ad., *imperfecta*, Desh, *mucronata*, Reeve, appear to represent quite a different group of ZONITIDÆ with almost membranaceous shells. The South Indian *H. ampulla* probably belongs to this group. The shells are somewhat allied to the new genus *Conulema* (type *H. attega*, Bens.), but the whorls are fewer and rapidly increasing. Their closest ally will probably be *Helicarion*, but an examination of the animals is necessary in order to determine the extent of the group.

I expect that several species of Albers' *Thalassia*, which chiefly includes Australian shells, will also be referable to *Rotula*, but I am not quite certain that Semper's *Euplecta* is sufficiently distinct from the typical forms of *Thalassia*.

ROTULA ANCEPS, Gould, pl. xvii, figs. 1—3.

*Helix anceps*, Gould, 1844, Bost. Journ., IV, p. 454, pl. xxiv, fig. 4; *eadem* Chem., Pfeiff., Reeve, &c., (? = *Nanina arata*, Blf.).

Chemnitz's figure of the species is excellent, but somewhat flatter forms also occur. The fresh shell is thin and transparent, covered with a shining epidermis; the striæ of growth are above strongly marked, crossed by fine spiral lines, the base is polished and with hardly traceable striæ of growth.

I found the species common to the south of Moulmein and near Amherst on trees and bushes in damp localities. At Damotha I obtained only four dead specimens on a limestone rock; they have distinctly a more solid shell, but do not differ in any other respect from those found on trees.

Typical specimens of Blanford's *N. arata* from Upper Burma (Proc. Zool. Soc. 1869, p. 448), differ by having the base of the last whorl less inflated and somewhat more distinctly striated, but the differences are such, as may easily be referred only to a local variation of *anceps*, the shell being larger and flatter.

The animal is dark grey with a distinct greenish tinge, darker on the front part of the head and on the pedicles. Foot long, slightly more than twice the longer diameter of the shell; lateral line distinct, rather high up above the edge of the sole; the portion of the foot above the line is obliquely furrowed, below it nearly smooth, or very finely striated. Posterior part of foot

tapering, obtusely truncate at the end; tail-gland with slightly thickened edges and a small hook-like appendage above. Sole of foot with two longitudinal, not very distinct, furrows; its middle part is a little broader than the lateral parts.

The outer mantle edge is slightly thickened. The left shell-lobe (*lsl*, in fig. 2) has below the angular periphery a linguat process, reflected over the basal part of the peristome, and ends with another shorter appendage near the shell retractor; the right shell-lobe (*rsL*.) has a linguat process at the posterior angle of the mouth, and another broader one covering the columellar lip. The left dorsal-lobe (*ldL*.) consists of a small linguat process next to the pulmonary opening and extends after a short interruption as an indistinct rim (in young specimens obsolete) along the inner side of the mantle. The right dorsal-lobe (*rdL*.) is considerably produced over the neck and recedes rapidly, barely reaching to the shell retractor.

The pulmonary cavity is spacious, with dark pigment arranged in some irregular transverse bands. The pigment is supplied from a long, blackish mass spread superficially over a white, albuminous gland (*pg*, in fig. 1), accompanying the dull yellowish kidney, next to which on the left side follows the heart (*h*). The mouth is large, fleshy; the salivary glands also large, on long strings and in the original position situated at the lower anterior end of the stomach; the latter is about  $1\frac{1}{2}$  volutions long, without any cœcal appendages; the intestines form only one twist and are surrounded by two lobes of the liver. A narrow albuminous gland (*ag*) accompanies the rectum.

The liver consists of several lobes: one is situated next to the hermaphrodite gland, while two others envelope the intestines; a fourth larger lobe begins at the lower end of the kidney and covers nearly the whole of the lower side of the stomach; the last  $2\frac{1}{2}$  volutions are also occupied by the liver.

The nervous system with its numerous branches does not differ in any essential particular from that of other ZONITIDÆ.

The genital organs occupy the right side of the dorsal cavity. In full grown specimens they are very complicated. The arrow-sac (*ag*) is very thick, twisted, angularly bent near the anterior



end, and internally provided with a strong, pointed papilla. This is composed of three entirely different layers of muscular tissue : the outer one consists of tough longitudinal muscles, the next is a thick layer of transverse muscles, and then follows a soft tissue in which longitudinal muscles prevail ; the inner cavity is in its entire length filled with an extremely fine granular substance, the granules being opaque and nearly equal in size. The hermaphrodite organ begins as a simple tube, the seminal receptacle branching off some distance from the opening, its end lies imbedded in soft tissue at the anterior part of the uterus. Where the seminal receptacle branches off the prostata possesses a small, dark, sessile, muscular appendage (*fa*). The inside of this resembled (in spirit specimens) a soft mass of fine reticulated threads, like spermatozoa. The *vas deferens* has about the middle a long appendage (*fl*.) which enclosed a very thin, elastic or spongy flagellum ;* after this the duct thickens into a gland, filled with white, ovately lenticular, calcareous particles, having the appearance of a milky substance, when that gland is cut upon. A short distance from the calciferous gland follows again a cœcal appendage, attached by a few muscular threads to the inner side of the mantle ; the terminal portion of the duct represents the true penis, it is somewhat bent and thickened near the middle, but it does not enclose a specially developed papilla for purposes of copulation.

One young specimen which I examined did not appear to have the amatorial sac developed, at least I was not able to trace it. The uterus was very thin ; the receptaculum seminis represented by only a very thin tube, twisted round the anterior part of the former. The *vas deferens* had a small flagellar appendage (*fl*.), but the flagellum itself could not be traced, and there were no calcareous bodies developed in the small enlargement of the duct next to the flagellar appendage.

The jaw (fig. 4) is rather narrowly semilunar, smooth, very slightly prominent at the median part of the concave front edge. In transparent light there is on it a very fine, somewhat irregular concentric striation perceptible, particularly near the front edge.

* This flagellum is entirely distinct from the sac with calcareous bodies, and appears to have the object of assisting the passage of the spermatozoa through the calcareous mass which fills the enlargement next to it.

The radula has about 75, almost straight, transverse, closely set rows of teeth, there being about 135 teeth in each row, (fig. 5). The median 25* teeth are subequal among themselves, but considerably larger than the outer ones, (about 55) on each side. The centre tooth is symmetrical, tricuspid, with the median point most prolonged, the lateral cusps being comparatively small and turned somewhat outwards and inwards; the following teeth twist more and more outwardly on either side, the large, strongly curved, points becoming always thinner and the outer lateral points slightly larger, until they nearly equal each other in size. At the same time the breadth of the teeth considerably decreases.

**Conulema, n. gen.**

(Type, *Helix attegia*, Benson, from Burma.)

*Shell conoidal, thin, consisting of many, usually spirally ribbed or striated whorls; base convex, narrowly or indistinctly umbilicated; margin of the aperture thin, not expanded; outer simple.*

Animal narrow, long, (generally equal to twice the greater diameter of the shell); pedicles long, tentacles much shorter, lateral line distinct, the margin below it smooth; gland at the end of foot large, superseded by a distinct horn; sole grooved; two shell and two dorsal-lobes to the mantle, all of them small and with no separately produced appendages, but slightly extended on either end; genital organs with, or without, an amatorial gland; a single appendage to the penis, produced into the penis retractor; receptaculum seminis terminating with a bulging end, attached to the anterior portion of the prostata. Jaw thin, transparent, smooth indistinctly or finely concentrically striated in the middle. Radula large, consisting of numerous (about 100) transverse rows, each with very numerous (300 to above 400) teeth, a few median teeth being conspicuously larger than the laterals which are narrow, pectiniform and very gradually decreasing in width.

Following E. v. Martens, Mr. W. T. Blanford referred the type species of this genus, with several other allied species, to Albers' *Trochomorpha*, but I have already (p. 225) noticed, that this name must be retained for an entirely distinct group, the type of which is *Tr. planorbis*, Lesson.

* In younger specimens somewhat less.

The Indo-Malayan species which have presently to be referred to *Conulema* are *Helix attegia*, (with *culmen*, Blf.), *infula*, *cacuminifera*, *arx* and *palmira*, Benson, *H. gratulator* and *confinis*, Blf., *Con. liri-cincta*, n. sp., and probably also *Nanina apicata*, Blf. and *H. hyphasma*, Pfr., from South India and Ceylon, *H. leucophlœa*, Martens, from Celebes, and a few others.

The genus is, as regards form and structure of the shell, closely allied to Semper's *Martensia** (Reisen im Archipel der Phil. &c., 2ter Theil, ivter Band, p. 42), but in this the right shell-lobe of the mantle is said to be entirely absent and the penis has two cœcal appendages, which have not been observed in *Conulema*. The presence or absence of an amatorial gland cannot be accepted as a generic character, which will be evident from what I shall presently say in comparing the generative organs of *C. attegia* with those of *C. infula*.

For Hutton's *Helix fastigiata* which may be identical with Pfeiffer's *Helix Barakpoorensis*, and *H. aspirans*, W. and H. Blf., Mr. W. T. Blanford proposed the name *Kaliella* (Ann. and Mag. Nat. Hist., Feb. 1863, vol. xi, p. 83). The anatomy of *H. Barakpoorensis* closely resembles that of *Conulema*, but the dentition is different, that species having fewer teeth in a transverse row and a great number of the median ones enlarged, all being squarish, not pectiniform.

CONULEMA ATTEGIA, Bens., pl. xviii, figs. 1—4.

*Helix attegia*, Benson, Ann. and Mag. Nat. Hist., 1859, vol. iv, p. 184, —*eadem* auctorum.

*Nanina culmen*, Blf., Journ. Asiat. Soc. Bengal, 1865, xxxiv, pt. 2, p. 72.

The animal is of a dull whitish colour ; the larger warts of the body, often possessing a pink tinge, are arranged in oblique rows ; the pedicles are grey, and this colour also extends over a part of the back ; ridge of the posterior part of the foot ashy grey ; mantle lobes light, or sometimes pinkish-grey ; inner part of mantle, forming the pulmonary sac, with spots and stripes of dark pigment, giving the shell, when the animal is retracted, a spotted appearance.

The mantle lobes are very slightly extensible. Those covering the shell are somewhat thickened near their margins, the left shell

* This name has already been employed in Botany.

lobe being slightly reflected over the edge of the outer lip, so as just to cover it. The right dorsal lobe is much larger than the left, which is represented by a mere thickened rim.

The general anatomy of the digestive and nervous organs and of the muscular system is exactly as in *Rotula*. The generative organs have a large and long uterus; the terminal swollen end of the seminal receptacle is imbedded in a soft tissue at the anterior end of the prostata; vas deferens short and extremely thin, widened before it enters the penis, the expanded portion being filled with a granular colouring pigment, in which, however, no calcareous particles were discernible. The penis is rather thick, posteriorly prolonged and attached by a thin muscle to near the end of the prostata. The amatorial gland is a very strong, tough, twisted tube, enclosing a pointed flagellum. A section of the median portion of the gland (see 1a on pl. xviii,) shews an external thick layer of longitudinal muscles, ( $\alpha$ ) then follows a layer of transverse muscles ( $\beta$ ), and after this a thinner, but very tough layer ( $\gamma$ ), enclosing a hollow space ( $\delta$ ), which in spirit specimens was filled with a jelly-like substance, mixed with harder flattened bodies of an irregular shape.

The jaw is semicircular, slightly projecting in the centre of the concave edge, smooth, about the median part indistinctly and very finely concentrically striated; the posterior part, along the convex edge and some distance from it, is not perfectly solidified.

The radula is very large, consisting of about 100, nearly straight or slightly undulating transverse rows. In a full grown specimen I counted 405 teeth in each row, the formula being  $200 + 2 - 1 - 2 + 200$ , and the total number of teeth about 40,000. The four median teeth are conspicuously larger, than those following on either side, all have a sharp pointed cusp at the anterior end. The centre tooth has besides two smaller cusps at each side and is symmetrical; the following are gradually more and more turned on either the right or left side, and the smaller cusps are, therefore, developed only on one side; the last lateral tooth is styliform.

The shell of *Conulema attega* is subject to a large amount of variation. The original specimen described from Tenasserim

was a thin horny shell, and probably not quite mature. Young shells have the periphery always very sharply carinated, and the spiral ribs or striæ on the whorls, as well as on the somewhat inflated base, are distinct. Specimens which live on foliage, or other kind of vegetation in low land, retain the thin horny structure of their shells, even when full grown, but the spiral striation of the whorls is often difficult to be traced. On drier places and on sandstone hills the shells become more solid and are covered with a thin horny cuticle; the spiral striation becomes very distinctly discernible, and there often appear intermediate striæ between the 4 or 5 stronger spiral ribs. A young specimen of this type has been described by Blanford as *Nanina culmen*. On limestone ground the shells become again more solid, often attaining a considerable thickness, and the specimens also grow to a larger size, but the spiral striation occasionally disappears almost entirely on the two last whorls.

The species is common about Moulmein, though not so much on low land as on limestone hills. The spiral angle of specimens collected in Burma varies from nearly 70° to 86 degrees. The following table will indicate some of the principal variations.

	Pegu.		Moulmein.		
Number of whorls,.....	6	8	6½	6½	7
Larger diameter, .....	5·8	13	7·	8·	11·2 mm.
Shorter diameter, .....	5·2	11·5	6·4	7·2	10· "
Height of shell, .....	5·5	12·	7·	7·5	10· "
Spiral angle, .....	72°	80°	70°	80°	86° "
	<i>culmen. attegaia.</i>		<i>attegia.</i>		

# CONULEMA INFULA, Bens., pl. xviii, figs. 5—9.

*Helix infula*, Benson, Ann. and Mag. N. Hist., II, p. 160,—*eadem* auctorum.

The animal of this species is identical in form and coloration with that of *attegia*, except that there is often a little more leaden grey on the upper posterior part of the foot, tinging the sole. The general organisation is also the same in both, with the only difference that in the genital organs the amatorial sac is entirely absent. The end of the seminal receptacle is attached by a fine thread to the anterior part of the prostata, and the albuminous gland of the uterus is comparatively larger than in *attegia*.

In specimens which I examined in winter the oviduct was anteriorly only slightly enlarged, but all larger specimens examined during the rainy season shewed a very conspicuous orange coloured swelling in that place (*ov*, in fig. 7, on pl. xviii). The ova composing it were in an advanced state of development, and some of them shewed already a spiral arrangement of dark corpuscles.

The jaw exhibits a rather distinct but very fine concentric striation, the median projection in the anterior concavity is very slight, and the convex edge is partially soft, granular, not entirely horny.

The radula is large, composed of about 100, nearly straight, transverse rows, each generally consisting of from 307 to 321 teeth, the seven median teeth being conspicuously larger than those following on either side, the formula being  $150 + 3 - 1 - 3 + 150$ ; and the total number of teeth is somewhat above 30,000.

The anatomy of the present species, when compared with that of the last, agrees, as already stated, almost perfectly. There is a slight difference in the terminal attachment of the seminal receptacle and in the number of enlarged teeth, but the only essential distinction lies in the absence of an amatorial sac in *infula*. I was at first inclined to attribute the absence of that organ to immaturity, but this view was not supported by the examination of specimens at all seasons of the year, and some which had fully developed ova. The only conclusion I can arrive at is, that the presence or absence of an amatorial sac cannot be considered as a character of generic importance, for it would be simply dragging classification into absurdity, if we would refer *infula* and *atlegia* to two genera, while almost every other point of organisation, the form and colour of the animals and of the shells, are nearly perfectly the same.

*C. infula* is a common* species in the neighbourhood of Calcutta; it occurs sparingly in Western Bengal and northwards up to the foot of the hills, and is also found near Poona and Balarampūr in Southern India. In none of these localities do the specimens attain the size of the Burmese *atlegia*, and when compared with ordinary

* A few years ago it was almost only seen in Orchid houses, but now it appears to become more generally distributed.

specimens of the latter, the spiral angle is generally found to be smaller, the whorls slightly more convex and the base of the last less inflated. However, these characters are all somewhat variable, and I collected specimens of *attegia* at Moulmein which are almost undistinguishable from the Bengal *infula*, the only difference being that the former are clearly immature, while the latter of the same size have all the appearance of full grown shells.

The following measurements have been taken from specimens of different localities.

	Calcutta.	Raniganj.	Poona.
Number of whorls, .....	6½	7	5½
Larger diameter, .....	7	7.5	5.5 mm.
Smaller, „ .....	6.5	7	5.5 „
Height of shell, .....	7	7.3	5.5 „
Spiral angle, .....	72°	74°	78°

I have not seen from any part of Bengal specimens larger than 8 mm. in the greater diameter, and those from the Western Ghats appear rarely to attain more than 6 mm. in the same diameter. The spiral angle varies in Bengal specimens from 65°—78°, on the average it is decidedly smaller than in *attegia* and may be taken at 74°.

***Conulema liricineta*, Stol., pl. xviii, fig. 10.**

Con. testa late conica, tenui, castanea, apice pallida, vel omnino pallidelutescente, anguste umbilicata; anfractibus 7, convexe gradatis, sutura impressa simplici junctis, quatuor liris acutis spiralibus cinctis: liris duabus medianis crassissimis, superna tenuissima; basi lævigata, prope peripheriam liris 3—4 tenuibus, approximatis notata; lineis incrementi subtilissimis et confertissimis; apertura sub-semilunari, labio columellari rectiusculo, brevi, supra paulo reflexo; labro tenui, simplici arcuato; diam. maj. 6.4, d. min. 6; alt. testæ 5.8, alt. apert. 2.5, lat. ap. 3 mm.

*Hab.* Prope Moulmein, ad flumen Ataran.

The species has the general form of a rather large and elevated *Con. palmira*, Bens., but the spiral ribs are more distant and stronger, except at the periphery which is less sharply carinated. I have not seen the animal, but judging from the general resem-

blance of the shell to that of *infula*, it is tolerably certain that both belong to one and the same genus.

*Genus.* SESARA, Albers.

Heliceen, edit. 2nd, p. 91, (see pl. xvi, fig. 4—10).

W. Blanford has already pointed out* the correct classification of this genus in the ZONITIDÆ, Albers having placed it as a subgenus of *Helix*. The type of the genus is *Helix infrendens*, Gould. It represents a group of small, lentiform ZONITIDÆ, composed of numerous whorls, transversely ribbed above and smooth below, generally imperforate, with a thickened columellar lip and a small aperture, being very often contracted by variously shaped teeth or ribs on the outer, or on the inner, lip, or on both of them. Young shells are very similar to those of *Rotula*, but can generally be distinguished by the thickened columellar lip.

I have examined the animal of *S. infrendens* and *pylaica*. Both are quite similar. The foot is very long, narrow, with the terminal gland distinct and a small, hook-like, pointed appendage above it. The sole has two longitudinal grooves, rather close together, the median portion being narrower than each of the outer parts. The mantle edge is nearly entire, the left shell-lobe is below internally considerably thickened, the left dorsal lobe is very small, or almost obsolete; the right shell-lobe is thin and somewhat convex, but without any separate appendage. The internal anatomy does not differ from that of *Rotula* and other ZONITIDÆ, but there is some peculiarity to be noticed in the arrangement of the genital organs.

I have dissected a young and an old specimen of *S. infrendens*. In the young I found, (see pl. xvi, fig. 4), a simple, rather thin uterus and a tube leading from the end of it to the penis, which had a long appendage.

In the old specimen (see pl. xvi, fig. 5,) the uterus, prostata, albuminous and hermaphrodite glands are of the usual form, but in the place where the *receptaculum seminis* should be situated I found a long, twisted, thin sac, partially divided in the lower part. This muscular sac contained three horny, curved tubes, (fig. 6), twisted

* Ann. and Mag. Nat. Hist., 3rd ser., 1863, xi, p. 84.



on the convex side, and provided with ramified appendages. Two of these tubes, terminated with a kind of leathery, white bags, each being provided at the end with a long horny flagellum, the third had none, but it may have been broken off. These leathery bags, together with the end retractor of the penis, were originally located at the end of the prostata ( $n$  in fig. 5). Between these horny tubes there was twisted a very long thread (fig. 7,) bearded in its entire length, and apparently consisting of a transparent, glassy substance. Of the same substance a few other simple threads were also observed (fig. 8).

The horny tubes are all hollow and apparently filled with a granular substance, of which, however, the terminal bags contained only a small quantity.

I can form at present no correct idea what the physiological and morphological value of this very singular and most complicated appendage is. Possibly it may in some form or other replace the seminal receptacle, or the arrow sac, for appendages containing similar horny tubes also occur in other ZONITIDÆ, (see p. 249), and in these a special seminal receptacle is also not developed. Examinations of living specimens, must, however, be made, in order to ascertain the true physiological facts.

The seminal duct has a long appendage enclosing a thin flagellum; next to it it is enlarged into a calciferous gland, the calcareous bodies being of a broadly ovate form, acuminate at either end; enlarged to 150 diameters they are seen only as the finest sand. The lower portion of the penis is rather muscular; towards the end it is strongly twisted.

The jaw is semilunar, rather narrow, smooth, finely radiately striated on the inner side and besides marked with very minute striæ of growth; it possesses an obtuse projection in the middle of the front edge.

The radula is large, composed of about 60 transverse series of teeth, arranged in almost perfectly straight lines. The central tooth has a single median rather abruptly contracted cusp, laterally it is only slightly flexuous, but not distinctly denticulate; it is somewhat smaller than either of the adjoining teeth. Ten teeth in each row on either side of the central tooth are conspicuously larger

than the following outer ones, which vary between 45 and 50, giving the following formula  $50 + 10 - 1 - 10 + 50$ . On the inner lateral teeth the median cusps are very long, pointed and hooked; the outer dentical is small and the inner almost obsolete. The outer lateral teeth become very rapidly bicuspid and narrow.

The examination of other species of this genus must shew which of the characters are to be regarded as particularly distinctive in comparison with allied forms. The small size of the centre tooth may be a useful character; but the chief difference probably lies in the genital organs which are quite peculiar, and require further explanation and comparison.

The typical species of *Sesara* are all from the limestone hills about Moulmein. They are *infrendens*, Gould, *pylaica*, Benson, *Tickelli* and *Attaranensis*, Theob. Three other species, *helicifera*, *Basseinensis* and *mammillaris* of Blanford are very probably also referable to the genus; they differ from the typical forms by possessing a thin simple outer lip. All three are also from the Burmese province.

#### SESARA INFRENDENS, (Gould.)

*Helix infrendens*, Gould, Bost. Journ., 1844, vol. iv, p. 453, pl. xxiv, fig. 6.—Hanley and Theob., Conch. Ind., pl. xv, fig. 2,—*eadem* auctorum.

*Helix capessens*, Benson, Ann. and Mag. Nat. Hist. 1856, vol. xviii, p. 250;—*eadem* auctorum.

There can be no doubt that the two forms, described by different authors under the above headings, are identical as to species. Neither Benson nor Pfeiffer could have compared Gould's original figure, otherwise they could not have mistaken the identity of the two species. Theobald's *Tickelli*, (Journ. Asiat. Soc. Beng., 1859, xxviii, p. 306; *eadem*, Pfeiffer; Hanley and Theob., Conch. Icon., pl. xv, fig. 3), appears to differ from it merely by a sharp peripheral keel.* Usually the two outer teeth of the basal outer lip are much closer together, than they themselves are with respect to the inner tooth of the lip. The former always have a common base, which becomes especially apparent when viewed from the internal side. It is extremely rare to find a

* Comp. W. T. Blanford in Ann. Mag. Nat. Hist. 3rd ser. 1863, xi, p. 84.

specimen in which the two outer teeth are as far distant as represented in Gould's or Reeve's figures; Chemnitz's figure is in this respect more correct. A comparatively very rare case is that the two outer teeth on the lip remain almost undeveloped even in full grown shells, but I have collected such specimens. In *Tickelli* the two outer teeth appear to be still closer together than they are usually seen in *infrendens*. The height of the shell of the latter species varies considerably, from nearly one-half to two-thirds of the longer diameter, and the last whorl becomes occasionally somewhat distorted. The largest specimen collected on the limestone hills at Damotha, near Moulmein measures: long. diam. 10·5, shorter diam. 9·7; height of spire 5·2; height of shell 6·5 mm. The corresponding measurements of one of the flattest full grown varieties are 9, 8·4, 4, 5·2 mm., and those of one of the highest forms 9, 8·8, 5, 6·2 mm.

The animal is pinkish white with gray pedicles and somewhat paler tentacles; sometimes the whole of the anterior body and the terminal part of the foot about the tail gland are leaden gray; the mantle is thick at the edge, sometimes white, but more usually pale orange with white minute specks.

SESARA PYLAICA, (Bens.)

*Helix pylaica*, Benson, A. and M. Nat. Hist. 1856, vol. xviii, p. 249; Conch. Ind., pl. xv, p. 2.

The internal thickening of the basal portion of the outer lip generally terminates abruptly near the periphery, occasionally forming a very distinct blunt tooth.

This species does not grow to an equally large size as the last and generally also remains somewhat flatter; the largest specimen measures larger diam. 9·5, shorter diam. 9, axis 4·3, height of shell 5·2 mm.; the corresponding measurements of one of the most elevated specimens are 9, 8·5, 4·8, 5·6 mm.

The animal is pinkish white, darker in front on the back and on the pedicles, as is also the last species; pedicles moderately long, tentacles rather short and paler gray; foot very narrow and long.

*Hab.* "Farm caves" near Moulmein; common.

Genus. *MACROCHLAMYS*, Benson.

Semper speaks (Reisen im Arch. der Philipp., III, pt. I, p. 17) of the receipt of "numerous specimens from Calcutta through Dr. Anderson" of *Macrochlamys splendens*, Hutton. This species was described from Máhasú, near Simla, where I also collected it some years ago. The shell has the outer lip internally thickened, a character which is peculiar only to hill species and is, I believe, chiefly the result of the testaceous, false, operculum not having been entirely absorbed after hibernation. It is by no means a constant character. *H. splendens* does not occur in or about Calcutta, nor anywhere in the plains, as far as I have been able to ascertain, but I found it, or a very closely allied form, at Missouri and at Nyneetal in the Himalayas. Dr. Anderson, as I have ascertained from himself, had not received any animals of the species in question from the N. West Himalayas, but those he sent to Dr. Semper were from Darjeeling, where a species, closely allied to Hutton's *H. splendens*, is very common, and, if not full grown, is very similar to a shell which is by Indian conchologists usually called *H. vitrinoides*, Desh.

There occur two allied forms of the *vitrinoides* type about Calcutta: one very flat, with the base conspicuously concave about the umbilicus; it is very closely allied to *M. lubrica*, Bens. The other is a little higher and is said to be *vitrinoides*, Desh. Both are thin shells, the former appears to have no trace of spiral striation; in the other the striæ become traceable when the superficial glossy polish is weathered off, but even then they are not nearly so strongly marked as in *splendens*. Neither of these Calcutta species agrees sufficiently with the original description of Deshayes's *Helix vitrinoides*, but there have been so many other allied species — *pedina*, *decussata*, *sequax*, *resplendens*, &c., and lately one or two by Semper and Martens—described, that it would be unsafe to augment the already confused literature with new names without previously most carefully comparing all the allied forms. Among all the Indian ZONITIDÆ the species of the *vitrinoides* type are certainly the most difficult of discrimination.

With reference to the name *Macrochlamys* itself, I would only observe that it is not correct, when Dr. Semper questions the generic determination of the Bengal *H. vitrinoides*, Desh., as a

*Macrochlamys* (setting aside for the present the question whether what is usually called *vitrinoides* be really that species or not). When Mr. Benson first mentioned the name *Macrochlamys* in Journal Asiatic Society, 1832, vol. I, p. 13, no one was able to assign a signification to the name; it was mentioned only *passim*. On p. 76 of the same volume, Mr. Benson quotes a *Macrochlamys indicu**, and from the reference on pp. 350 and 351† in vol. V, of the same Journal (1836) it is, I think, tolerably clear that under the above name the Bengal species, usually recorded as *vitrinoides*, was meant. Consequently this species must be taken as the type of *Macrochlamys*, whether it be called *vitrinoides*, or *indicus*, for both, if different, are no doubt very closely allied. Gray quoted‡ *vitrinoides*, Desh., as one of the species of his newly proposed genus *Nanina*, but the name, having been previously generically used by Risso, cannot be adopted.

From Mr. Benson's own record§ we know that a landshell called *Tanychlamys* is identical with *Nanina*, but only in 1836, (vide note) are we informed that *Tanychlamys* is the same thing as *Macrochlamys*, and that the Bengal *vitrinoides*, Desh., is the type of the genus. Thus there is no reason to be given why the latter generic name should be superseded by the former.

I have given the historical record in order to shew, that *Macrochlamys*, if at all adopted as a generic denomination, must be used for the group of which the so-called Bengal *vitrinoides* (or rather *M. indicus*, Benson,) is the type, for if we do not acknowledge it for that type, the name would lose all claim to priority. Albers (*Heliceen*, 2nd edit. p. 57) distinctly quotes *H. (Nanina) vitrinoides*, Desh., as the type of his genus *Orobia*, but Dr. Semper (loc. cit. p. 18) again appears to ignore that fact, and to retain *Orobia* in some other form. When really correct definitions of genera have to be obtained, there is nothing very objectionable in this course, though it cannot be recommended; but whenever type species of genera are mentioned, changes of those generic significations should be made with particular care.

* This name appears to have been entirely overlooked; it will very likely have to come now into use. *Helix Indica*, Pfr., is a *Rotula*.

† This reference also shows that the subsequently used name *Tanychlamys* was applied to the same shell as was *Macrochlamys*.

‡ Proc. Zool. Soc. Lon. 1834, p. 38.

§ Ibidem, p. 89.

MACROCHLAMYS [DURGELLA] HONESTA, Gould, pl. xvii, figs. 6-14.

*Helix honesta*, Gould, 1846, Proc. Bost. Soc. Nat. Hist., II, 98, *eadem* auct.

This is, like many other allied forms, an extremely variable species.

Gould's original specimen represents a very flat and apparently young shell. I have a young specimen from Pegu, rather strongly keeled at the periphery, horny, translucent, and with a peripheral rufous band; it exactly agrees with Gould's measurements. The specimen from Pegu figured on plate xvii, figs. 6, 6*a*, 6*b*, is a full grown shell of the same type and is identical with the one described by Pfeiffer in Monag. Helicorun, vol. i, p. 57. This variety has the outer lip barely descending at the aperture, but it has the characteristic oblique mouth, as noted by Blanford (Journ. A. S. B., 1865, vol. xxxiv, p. 87).

Another variety occurs in Pegu (see fig. 7, pl. xvii,) which is higher and has the last whorl rather rounded, or barely keeled at the periphery, but the outer lip is not descending. Larger diam. 13, smaller diam.  $11\frac{1}{2}$ , height 8 mm. The same variety also occurs in Arracan and in the Khasi hills, and appears to represent the Bengal *M. vesicula* and *lecythis*, Benson, of the Rajmahal hills, both when young being almost undistinguishable. Reeve's figure of *honesta*, (Mon. Hel., pl. 84, fig. 452), appears to represent the above noticed variety, but it also could be taken for either of the two last noted species.

A third variety occurs at Moulmein and in Upper Burma. This (see fig 9, pl. xvii,) has the whorls above strongly convex, the last almost evenly rounded at the periphery, and at the aperture the outer lip considerably descending, thus causing its narrow shape. It is a very common shell on all the limestone hills about Moulmein, and very closely resembles externally *Sophina Calias*, except that it wants the umbilical carina and slit. The usual size is 11 or 12 mm.; the largest I observed measures, larger diam. 13.3, smaller 11, height 8 mm. Sometimes specimens are met with which appear to attain a somewhat irregular growth after a certain age (see fig. 8, pl. xvii,) ; the additional portion (*a b*) of the whorl being always considerably thinner than the rest of the shell, and

marked with stronger striae of growth. The measurements of the largest specimen of this variety are: larger diam. 13·6, small diam. 12·2, height 9·5 mm.

When fresh, the shell of [*Durgella*] *honesta* is always horny and translucent, the whorls at the sutures adpressed, the surface smooth and polished, except on the last whorl where, near the suture and round the umbilicus, a fine spiral striation is usually observable. The aperture is always oblique, with the upper, or sutural, margin of the outer lip considerably more produced, than the lower or umbilical margin; the inner lip is very thin and the columellar lip at the base distinctly reflected and somewhat thickened, so as almost entirely to cover the umbilicus.

Full grown shells are comparatively solid, especially those occurring on limestone ground, but the young are generally of very thin texture and their aperture also has not the oblique form of the old shell. This makes the former very closely to resemble young specimens of *Macroch. vesicula* or *lecythis*, as has already been noticed.

The animal of the Moulmein variety is narrow, very long, pale white, pedicles and the terminations of the tentacles leaden grey, as well as the upper part of the foot posteriorly; the tail gland is superseded by a very distinct hook; the mantle lobes are well developed, both the upper portions being reflected over the shell. By some accident, however, my spirit specimens were lost and I am, therefore, unable at present to give sufficient details regarding the anatomy of this species. Semper (Reisen in Arch. der Phil., vol. iii, pt. I, 1870, p. 18,) gives some anatomical details of a dried up specimen received through Dr. Anderson, but not, as is stated, from the Andamans. Dr. Anderson had collected his specimens in Upper Burma, when with the Yunan expedition, and some of these specimens he forwarded to Dr. Semper; the species does not occur on the Andaman islands.

I have also examined some of these dried Burmese specimens, and I find the animals agree in external characters exactly with the Moulmein ones. The tail gland is superseded by a very distinct hook; the centre portion of the sole is narrower than the outer portions. The left shell lobe has two linguæ appendages, one extending over the peripheral portion of the shell, the other, a

shorter one, over the base; the upper portion of the right shell lobe is linguat, very narrow and long, the lower short, thick, partially reflected over the lower part of the inner lip. The left dorsal lobe is short and thick above, the right thinner, but larger and extending over the neck.

Semper says that the genital organs of *honesta* are perfectly similar to those of the supposed *splendens*, Hutton, mentioned on p. 246. I have not been able to trace the arrow sac, but there is in full grown specimens a sac connected with the genital system, which contains a peculiar horny, curved, hollow organ (pl. xvii, fig. 13). The anterior end is trumpet shaped, for some distance from that end the sides are provided with various, branched, horny appendages and the whole terminates with a sac, filled with very thin, variously twisted strings, containing intermixed elliptical, transparent, solid bodies. I have not been able to trace in the present species the exact position of this strange organ, but one of a similar kind occurs in *Sesara infrendens*, and in this it is certainly an appendage of the oviduct. The physiological function of the organ itself I am at present unable to indicate.

The jaw is rather narrow, smooth, with the sides slightly curved outward, and with an obtuse median projection in the middle of the front edge; the general form resembles that of *Microcystis*.

The radula is long, composed of about 80 transverse series of teeth; about 23 median teeth in each series being considerably broader than the outer ones, which are on either side about 30 or 35 in number. The centre tooth is symmetrical, tricuspid, the following turn outwards on each side, and the last teeth have two subequal short cusps.

The great development of the lobes of the mantle, and particularly the form of the jaw, the inequality in the teeth and the presence of the peculiar appendage in the genital system indicate distinctions which may be sufficient for separating the present species generically from *Macrochlamys*, and in this case Mr. W. Blanford's name *Durgella* would most probably be applicable to it. This name has been proposed for Benson's *Helix levicula* from Tenasserim, as type, and would indicate a close relation, both in the form of shell and the characters of the animal, to *Helicarion*. Whe-



ther Blanford's *mucosa*, and in that case also *lecythis* and *vesicula* of Benson belong to the same genus or subgenus, I am not at present prepared to affirm.

*Genus. MICROCYSTIS, Beck.*

(Semper, in Reisen im Arch. der Philipp., III, pt. i, p. 43.)

This genus does not appear to have many representatives in India, unless some of the small species, like *H. Neherensis*, *petasus*, *patane* of Benson &c., should prove to be more related to it, than to *Macrochlamys*, though this is not very probable. A few Himalayan species, like *Hodgsoni*, *rorida*, &c., are, however, probably referable to *Microcystis*.

*MICROCYSTIS MOLECULA, Benson, pl. xviii, figs. 11-13.*

*Helix molecula*, Benson, Ann. Mag. N. H., 3rd ser., III, p. 389.

The species is very common about Moulmein, Rangoon and on the Arracan coast, on limestone as well as on sandstone hills, not uncommonly also on foliage. Specimens measuring 4 mm. in the large diameter, and 3 mm. in height, may be considered of large size; those usually met with are somewhat smaller. The largest specimen was obtained at Zwagabin on the Salvín river; it is rather pale brownish green; larger diam. 5.6, smaller diam. 5, height 4.5 mm.; this form approaches *Helix Poongee*, Theob.

The animal is grey, varying in shade, sometimes almost black; foot moderately narrow, paler at the sides; lateral line distinct; sole with two grooves; tail gland distinct, with a hook-like appendage above it; length of the animal 3—4 times the diameter of the shell. The left mantle lobe is reflected over the outer lip, but is not much produced, right mantle lobe above shortly linguatate. The genital organs are quite simple. The uterus has no appendages; it terminates with a long, narrow, albuminous gland, and the hermaphrodite duct is of great length. The *vas deferens* branches off at about the middle length of the uterus; it has a small calciferous sac where it passes into the penis, which is attached by a short muscle, and after a short twist at about the middle of its length enlarges into a muscular, soft, spongy thickening; this enlargement did not contain calcareous particles. No seminal

receptacle, nor an amatorial sac has been observed, though the single specimen examined appeared to be full grown.

The jaw is almost semicircular, very thin, smooth, broad; the terminal corners of the anterior concave edge are somewhat roundly projecting, and the middle part has a very slight tooth.

The radula appears to be comparatively large, but I have not seen it perfect. The teeth are arranged in almost straight, transverse rows, about 120 in each row, the median teeth in each row being conspicuously larger than others. The centre tooth is, as usually, symmetrical, tricuspid, the middle cusp being very long, pointed and curved; the lateral cusps are much smaller and below them there is on each side a second small blunt denticle present. The lateral teeth are turned outwardly on either side, the inner lateral cusp becoming smaller, while the outer slightly increases in size, until on the last laterals it almost equals the principal cusp.

*Genus, SOPHINA, Benson.*

*Ann. and Mag. Nat. Hist.*, 1859, vol. III, p. 473.

The shells of *Sophina* are characterized by a more or less thickened columellar lip, forming with the basal portion of the outer lip an angle, and producing a ridge round the umbilicus; they are of small or median size, sub-orbicular shape and thin structure.

Three species have been described by Mr. Benson, one of which turns out to be only a variety of another, and I shall now add two new species. All are from the neighbourhood of Moulmein, and are only found on limestone hills. The animals are very similar to each other, and it will suffice to give some details of the type of the genus. All of them can fully retract their bodies in the shells, but sometimes with difficulty as in *Helicarion*, to which *Sophina*, on account of the great development of the mantle lobes, bears a close relation.

The foot of *S. calias* is very elongated, rather narrow, with a very distinct lateral line, marked with oblique furrows above it, nearly smooth below it down to the edge of the sole. The posterior end is obliquely truncate, occupied by a large, high gland and superseded by a distinct horn-like appendage. The sole has two longitudinal grooves, dividing it in three, subequal parts, the inner being somewhat narrower than the outer parts; the grooves are usually well

traceable on spirit specimens, but during life they are not equally easily discernible. Pedicles about half the length of the body, tentacles about one-fourth of the length of the pedicles, both with swollen tips. Mantle conspicuously thickened near the margin, its external edge very short, entire and continuous. The left shell lobe is very large, entire, reflected over the edge of the outer lip, and below considerably produced; the right mantle lobe is divided into two parts, the upper is linguat, narrowly produced and covering the base of the shell, partially also extending on to the upper surface of the penultimate whorl, as in *Macrochlamys*; the lower portion is shorter, somewhat folded and reflected over the columellar lip. The dorsal lobes are well developed and entire, the left is a little larger, and both are thickened round the pulmonary orifice; the right considerably extends over the side of the neck. Hermaphrodite opening situated at the upper, somewhat outer, base of the right pedicle. The shell retractor is flattened and considerably thickened, forming sharp angles, above and below, with the body. Its strong development is apparently due chiefly to the circumstance that the animals always crawl on hard rock.

The general anatomical structure offers nothing very particular and will be much better understood by an inspection of figure 1, on pl. xix, and by a comparison of the accompanying explanation, than by a lengthened description. The anterior part of the alimentary canal is comparatively short, the stomach extends over one and a half volutions of the shell, it has no appendages. The last two volutions are entirely occupied by the liver which has the usual paler or darker greenish colour. The hermaphrodite gland is in its original situation placed about the end of the stomach. The kidney (*k*) is an elongated, rather more granular than plicated gland, placed at the side of the heart, it possesses a special long duct (*kd*), accompanying the rectum, and terminating a little short of the anus.

The genital organs (fig. 2, pl. xix,) chiefly occupy the anterior part of the body. The arrow sac is short and thick, with an enclosed thick, pointed papilla. The uterus, accompanied by the prostata, is very long, thick, the former has a yellowish colour with a greenish tinge, the latter is purely white; terminal albumin-

ous gland (*ag*) of moderate size, slightly thickened; hermaphrodite gland (*hg*) large, rather flatly depressed, connected with the uterus by a long twisted duct (*hd*). The vas deferens (*vd*) branches off a short distance from the hermaphrodite opening; in about three-fifths of its length from its origin it has a long pointed appendage (*ep*), consisting of strong tissue, filled with minute, elliptical, calcareous secretions; this appendage is attached by a special muscle close to the place of attachment of the arrow sac; the last two-fifths of the vas deferens gradually widens, and towards the end the simple tube consists internally of remarkably soft, muscular tissue, but there is no papilla present. The receptaculum seminis (*rs.*) is a globular gland, attached to a long, slightly twisted string, originating from the oviduct, quite close to the hermaphrodite opening.

I may here record an observation, which I have repeatedly made *viz.*, that there is a very great difficulty in tracing spermatozoa in the hermaphrodite gland. Eggs are certainly formed there, but they further develop to an appreciable size in the uterus, into which the necessary amount of albumen is supplied from the albuminous gland. Spermatozoa I could not, in this case, detect in the hermaphrodite gland; they must be of extreme minuteness, but they become fully developed in the hermaphrodite duct or string (*hd*); in fact this duct almost entirely consists of spermatozoa in nearly all terrestrial Mollusca which I have examined.

The jaw of *S. calias* is broadly semilunar, thin, apparently smooth, but when moderately enlarged and viewed in transparent light, a distinct concentric striation is perceptible and there are also some very minute radiating lines to be observed near the middle part. A fringe of muscular tissue is attached to the convex side, the concave margin is usually entire, but in one instance (see pl. xix, fig. 3 *a*), I observed a very distinctly developed projection in the middle; this example is taken from the var. *schistos-telis*, but other specimens of the same variety, and equally large, did not possess it. The jaws of *S. discoidalis* and *conjungens* are similar to those of *calias*, only differing very slightly in shape; in both there is a small projection at the centre of the concave margin, and both are also finely concentrically striated, like the jaw of *S. calias*.

The radula is elongately quadrangular, consisting of about 35 to 50 transverse rows of teeth, meeting at sharp angles in the middle line; there are about 80—100 teeth in each row. They are all of a similar shape, pyramidal, sharply pointed and attenuated in front, gradually becoming wider and terminating with an obtusely rounded base. The middle tooth is slightly contracted below the middle, it is symmetrical; the laterals are gradually more bent outwards on either side and possess on the outer side near the point, a rounded and angular projection; the angle appears to be directed posteriorly; the outermost teeth are quite simple.

The teeth of *S. discoidalis* and *conjungens* are exactly similar to those of *calias*, only comparatively smaller. The jaw and radula of *S. forabilis* were not examined.

SOPHINA CALIAS, Bens., pl. xix, figs. 1—4 and 7—9.

Ann. Mag. Nat. Hist., 3rd ser, III, p. 473,—*eadem*, Pfeiffer, Mon. Hel., vol. v, p. 111 and 112.

Syn. *Sophina schistostelis*, Bens.

Soph. testa sub-globosa vel orbiculato depressa, solidula, pallide cornea, polita; anfractibus  $4\frac{1}{2}$ — $5\frac{1}{2}$ , convexiusculis, sutura continua adpressa sejunctis; striis incrementi minutis, confertissimis, infra suturam levissime canaliculatis et striis spiralibus nonnullis notatis; anf. ult. ad peripheriam rotundato, ad basin leviter convexo, modice umbilicato: umbilico circa duodecimam partem diamet. maj. testæ æquante, profundo, carinâ crassiusculâ circumdato; apertura rotundate et depressiuscule semilunari, labio adnato crassiusculo, albo, ample expanso; columella crassa, valde obliqua, conspicuiter, precipue ad basin, dilatate reflexa, in aspectu frontali umbilicum fere omnino tegente, rugulata, ad medium subdenticulata; labro simplici, intus paululum incrassato, ad marginem obtusiusculo, supra ad suturam producto, infra margine basali levissime curvato; carina umbilicali profunde et angustissime incisa. Diam. maj. spec. maximi 13·5; d. min. 11·8; axis 7·6 mm.; altitudo 8·5; alt. apert. 6·1, lat. ap. 6·4 mm.

Var. *schistostelis*, (fig. 8) testa ultimo anfractu multo majore, tenui, pellucido; apertura semilunari, marginibus tenuissimis: labro

columellari modice obliquo, levi, supra reflexo, labro supra paulo flexuose producto, ad basin fere recto; carina umbilicali distincta, tenui, ad aperturam paulo incisa. Diam. maj. spec. max. 17 mm.; diam. min. 14.5; axis 8.5; alt. testæ 11, alt. apert. 8, lat. apert. 9 mm.

The species offers a remarkable instance of variation during different stages of growth. As the type, I consider the smaller form with a solid shell, the columellar lip very oblique and rugose, the outer lip obtuse and internally slightly thickened, and the umbilical ridge with a deep incision. This type is represented in fig. 7, on plate xix. Small specimens, measuring only 5 mill. in the larger diam., occur of exactly the same form; it seems, therefore, that they often attain maturity at an early stage.

Very commonly, however, it is the case that the shells grow further, after they have attained that certain stage of maturity. The increase amounts from one-third sometimes to one and a half circuit of a whorl, as indicated in the figure 8 *b*. This additional portion of the shell is always thinner than the rest, and more transparent, the outer lip of the aperture is at the suture less produced on to the penultimate whorl, the columellar lip less oblique, thin, smooth, and the umbilical ridge is only slightly incised. In this stage, the species was described by Benson as *Soph. schistostelis*, and it is certainly a most marked variety. There can, however, be no doubt that it is only an abnormal growth, for when the terminal half of the last whorl, indicated in fig. 8 *b*, is broken away, a typical *Soph. calias* of the shape, represented in fig. 7, 7*a*, 7*b*, can be obtained.

There appears to be no rule as to the size of the shell at which the abnormal growth begins, (or in other words at which a *S. calias* is changing into a *S. schistostelis*), but the latter is locally so constant, that very few specimens stop growth at the normal stage, while the abnormal forms are met with in thousands. It is really difficult to decide in such cases, whether we ought to call these abnormal forms distinct species or not. But the fact clearly shews, how species are developed, one out of the other. In this special case no one will doubt the propriety of regarding the larger form as an abnormal growth of the smaller one, because the original type can still be traced. But supposing

the peristome of the normal shell had been entirely absorbed, and then the growth proceeded as usually; in such a case it would be much more difficult, and sometimes quite impossible, to trace the connection of the two forms, which could then with more propriety be acknowledged as two distinct species.

When after hibernation the calcareous covering or false operculum of the aperture has not been perfectly dissolved, the inner peristome becomes sometimes irregularly thickened, as if it had been injured, (fig. 9 of pl. xix,) and then imperfectly restored.

The animal is whitish or pale fleshy gray, slightly darker on the head, and on the pedicles and tentacles; mantle white in young, grey near the edge in older, specimens; posterior end of foot often tinged gray.

*Hab.* The species is very common on the limestone hills to the east and south of Moulmein.

*SOPHINA FORABILIS*, Bens., pl. xix, fig. 10.

Ann. Mag. Nat. Hist., 3rd ser. vol. iii, p. 389;—*eadem*, Pfeiffer, Mon, Hel., vol. v, p. 112.

*Soph.* testa depressiuscule semiglobosa, parva, tenui, cornea, nitida; anfractibus 5—5½, convexiusculis, sutura adpressa, vix canaliculata, junctis, striis incrementi filiformibus confertissimis et in anf. superioribus striis spiralibus, aut subtilissimis aut fere omnino obsoletis, tectis; ult. anf. ad ambitum rotundato, ad basin leviter convexiusculo, perforato; umbilico latiusculo 0·16 partem long. diam. maj. æquante, carinâ distinctâ, albidâ circumdato, ejusque lateribus interioribus verticaliter descendentes; apertura rotundate semilunari, labio albido, tenuissimo, breviter expanso; columella prolongata, paulo incrassata, recta, fere verticali seu paulo obliqua, ad basin breviter reflexa; labro tenui, fere recto, supra vix flexuoso et paululum producto, infra leviter convexo et cum columella angulum circa 115° formante; emarginatione carinæ umbilicalis brevi. Speciminis max. diam. maj. 8·8 mm.; min. 7·5; axis 5; alt., 5·8; alt. apert. 3·8; lat. ap. 4 mm.

This species may be regarded as the diminutive of the variety *Soph. schistostelis*, but it is readily distinguished from it by its less convex base and comparatively large umbilicus; it never seems to

grow to a large size, and is always of a horny brown colour, with the umbilical carina often white.

The animal is dull white, with grayish pedicles and tentacles, foot very narrow, the glandular appendage not very prominent.

*Hab.* I only found *forabilis* on the limestone hills at Damotha near Moulmein, where no other species of *Sophina* occurred.

***Sophina discoidalis*, n. sp., pl. xix, figs. 5, 11, 12.**

*Soph.* testa depressa, subdiscoidea, tenui, pallide cornea, pellucida, cornea, nonnunquam circa peripheriam faciâ castaneâ notata; anfractibus 5—5½, convexiusculis, striis incrementi subtilissimis notatis, suturâ adpressâ, leviter canaliculatâ disjunctis, et infra suturam lineis spiralibus impressis et paucis notatis; apice paululum prominente; anf. ult. ad ambitum compressiuscule rotundato, ad basin levissime convexiusculo, prope medium paulo depresso et perforato: umbilico amplo, 0·15 partem diam. maj. long. æquante, carinâ perdistinctâ, filiformi, circumdato; apertura depresso semilunari, marginibus tenuibus instructa: labio parietali adnato tenuissimo, columellari brevi, crassiusculo, obliquo, ad basin conspicuiter reflexo, ad carinam recurvato; labro tenui, fere recto, supra peripheriam paululum producto; carina umbilicali modice incisa. Speciminis max. diamet. maj. 10·5 mm.; min. 9; axis 4·5; alt. 5·5; alt. apert. 4·4; lat. ap. 4·7 mm.

*Hab.* On the limestone hills of the so-called 'Farm Caves,' on the Ataran river and also on similar hills south of Moulmein.

The depressed shape of this species, together with a comparatively large and strongly carinated umbilicus, readily distinguish it from other *Sophinae*. The specimens which I collected at the Farm Caves and south of Moulmein are all of a uniform pale straw colour, but I have lately received from Mr. Theobald a few which were obtained further eastwards on the Ataran river, and these possess a very distinct brown band above the periphery of the last whorl (see pl. xix, fig. 12); there is, however, no other specific difference between the two.

Animal pale yellowish or brownish white, posterior end of the foot about the gland generally tinged with gray.



***Sophina conjungens*, n. sp., pl. xix, fig. 6, 13.**

*Soph.* testa semigloboso orbiculata, tenui, semipellucida, cornea, in speciminibus junioribus fere hyalina; anfractibus  $5-5\frac{1}{2}$ , convexiusculis, suturis adpressis vix canaliculatis sejunctis, striis incrementi tenuibus et alteris spiralibus subtilissimis tectis, nonnunquam albide strigatis seu fasciatis; anf. ult. ad peripheriam rotundato, ad basin leviter convexo, modice umbilicato: umbilico 0.13 part. diam. maj. long. æquante, carinâ obtusâ indistinctâ, nonnunquam fere obsoletâ, circumdato; apertura semilunari, marginibus tenuissimis instructa: labio adnato expansiusculo, columellari vix incrassato, obliquo, ad basin paulo reflexo; labro fere recto; emarginatione umbilicali minima. Speciminis max. diamet. maj. 11.6 mm.; minor 10; axis, 6.2; alt. 7.2; alt. apert. 5.3; lat. ap. 5.6 mm.

*Hab.* South of Moulmein.

This species represents in some respects a connecting link between *Macrochlamys* (particularly the subgenus *Durgella*) and *Sophina*, the umbilical carina being sometimes nearly obsolete, but it is always indicated by an obtuse angle accompanied below by a slight furrow and by a small emargination at the peristome. The shell when young is almost diaphanous, and very thin; older specimens become partially opaque, especially near the sutures. The thin horny, transversely finely striated cuticle is sometimes interrupted by white spiral striæ or bands on the whole surface, or only below; near the umbilical edge the striæ of growth are generally also more distinctly marked than elsewhere.

The animal is greenish white, somewhat darker about the head, but in no respect different from that of other *Sophina*.

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DESCRIPTION OF FOUR NEW SPECIES OF MALAYAN BATS, FROM THE COLLECTION OF DR. STOLICZKA,—by G. E. DOBSON, B. A., M. B., *Asst. Surgeon H. M.'s British Forces.*

[Received 3rd May, read 26th June, 1871.]

CYNOPTERUS BRACHYSOMA, Dobson.

Head broad, with prominent zygomatic arches, general shape triangular; muzzle pointed, deeply emarginate between the nostrils; ears moderate, conical, with rounded tips, not margined with white.

Body very short and thick, everywhere clothed with long, dense fur, of a peculiar slatey-blue colour, with a grayish or silvery tinge, the tips of the hairs sooty-brown. The fur of the back is continuous with that of the abdomen through the notch in the interfemoral membrane, and completely conceals the tail which is very short and slender. Upper surface of interfemoral membrane thickly covered with hair; beneath, the triangular portions on each side of the tail have a few scattered hairs only on their posterior margins. Above, the fur of the back extends upon the wing membrane as far as a line drawn between the elbow and knee joints, covering it with rather long hair, also upon the humerus, half the length of the forearm, the femur, and proximal end of the tibia; beneath, the antibrachial membrane is dusted over with a few, very short, fine hairs; the wing membrane is clothed to about the same extent as on the upper surface, but the hairs are very short, and thinly spread.

Dentition.—In.  $\frac{4}{4}$ ; c.  $\frac{1-1}{1-1}$ ; p.m.  $\frac{2-2}{3-3}$ ; m.  $\frac{2-2}{2-2}$ .

The description of this new species is taken from an adult female specimen preserved in spirits.

	Inches.
Length, head and body .....	2.9
"    tail, .....	0.25
"    head, .....	1.25
"    eye to tip of nostril, .....	0.4
"    ear (anteriorly), .....	0.6
Breadth, ditto, .....	0.35
Length, forearm, .....	2.2
"    second finger, .....	4.0
"    fourth ditto, .....	3.0
"    thumb, .....	0.9
"    tibia, .....	0.8
"    foot and claws, .....	0.5
"    calcaneum, .....	0.2
Expanse, .....	14.0

*Loc.* Andaman Islands.

## MACROGLOSSUS SPELÆUS, Dobson, pl. x, fig. 3—4.

Head long; muzzle narrow; nostrils with an intervening emargination which also passes down to the lip; tongue very long and pointed; ears conical with rounded tips.

Wings ample, from the sides of the hairy back; wing-membrane attached to the back of the foot, and extending to the base of the outer toe; thumb rather short, terminal phalanx longest, with its base included in the membrane; index finger of two phalanges *without any trace of a claw*.

Body clothed with very short and thinly spread fur of a uniform dark brown colour. In front the fur of the head extends upon the face as far as the inner canthuses of the eyes, leaving the remaining portions naked; from the back it passes on to the humerus and forearm, covering half the length of the latter; behind, on each side, it covers a triangular portion of the interfemoral membrane, bounded laterally by the femur, and posteriorly by a line drawn from the knee joint to the base of the free portion of the tail; beneath, the whole surface of the antebrachial membrane is covered with short hairs; laterally, the fur of the sides extends upon the wing membrane as far as a line drawn between the elbow and knee joints, also outwards along the posterior margin of the forearm to the carpus, occupying a space varying in width from one inch behind the elbow to half an inch or less at the middle of the forearm; the under surface of the humerus and femur, and half the length of the forearm are also hairy.

The tail is about half an inch in length, and rather thick, and contrasts remarkably with the diminutive member possessed by the only other known species of the genus, *M. minimus*.

On each side of, and a little behind the anal opening two small, subcutaneous, gland-like bodies are placed. These bodies are oval, have the skin tightly stretched over them, and are not covered by the fur which clothes the neighbouring parts. As the specimens from which the description of these bodies is taken are those of females, it is not known if they also occur in the males of this species.

The tongue is very long, pointed, and protrusible; in the spirit

specimens it can be drawn from the mouth for nearly half an inch without using any forcible extension; the anterior half of its surface is thickly covered with soft, recurved papillæ, which increase in length towards the tip.

In the form, number, and arrangement of the teeth, the dentition corresponds precisely with that of *M. minimus*. As might be expected from the greater size of the animals of this species, the teeth are considerably larger than those of *M. minimus*, and but for this difference, it would be impossible to distinguish the lower jaws of the two species; in the upper jaw, however, the first premolar is minute, and relatively smaller, compared with the other teeth, than in *M. minimus*.

Dentition.—In.  $\frac{4}{4}$ ; c.  $\frac{1-1}{1-1}$ ; p.m.  $\frac{2-2}{3-3}$ ; m.  $\frac{3-3}{3-3}$ .

	Inches.
Length, head and body, .....	4.2
„ tail, .....	0.45
„ head, .....	1.55
„ eye to tip of nostril, .....	0.6
„ ear (anteriorly), .....	0.75
Breadth, ditto, .....	0.4
Length, forearm, .....	2.75
„ second finger, .....	4.6
„ fourth ditto, .....	2.85
„ thumb, .....	0.7
„ tibia, .....	1.15
„ foot and claws, .....	0.7
„ calcaneum, .....	0.2
Expanse, .....	16.6

*Loc.* Farm Caves, near Moulmein, Tenasserim province.

PHYLLORHINA NICOBARENSIS, Dobson, pl. xx, fig. 2.

Head long, muzzle obtuse, thick; ears large, acutely pointed, outer margin slightly concave below the tip, conch marked with transverse striæ; no central pore behind the nose-leaf, but on either side above the eyes a wart-like eminence having on its summit the opening of two minute pores around which long straight hairs arise. Upper portion or crest of the transverse nose-leaf simple, forming an arc of a circle, folded or rolled back on itself and overhanging the concave base which is divided into *two cells only* by a single central longitudinal fold; in front, the horizontal, horse-shoe shaped membrane has three small points on its anterior margin.

Wings broad, wing-membrane attached to base of metacarpal bone of outer toe ; feet slender, tail of six vertebræ, the last free.

The fur of the back extends upon the humerus and femur for about half their length, and to the same distance on the intervening wing-membrane ; re-appearing at the elbow it passes outwards along the posterior edge of the forearm on the wing-membrane reaching half way to the carpus ; beneath, the distribution of the fur upon the humerus, femur, and intervening wing-membrane is similar to that above, but the hairs are considerably longer.

The interfemoral membrane is naked above except at the root of the tail ; beneath, the fur of the abdomen extends upon it as far as the end of the second vertebra.

Hair, tricoloured above, light brown at base, then grayish, with light brown tips ; beneath, dirty-white.

Dentition.—In.  $\frac{2}{4}$  ; c.  $\frac{1-1}{1-1}$  ; p.m.  $\frac{2-2}{2-2}$  ; m.  $\frac{3-3}{3-3}$ .

	Inches.
Length, head and body,.....	3·0
„ head,.....	1·1
„ tail,.....	1·7
„ ear (anteriorly), .....	0·9
Breadth, ditto, .....	0·8
Length, forearm, .....	2·6
„ second finger, .....	3·7
„ fourth ditto, .....	2·8
„ tibia, .....	1·0
„ foot and claws, .....	0·45
„ calcaneum, ...	0·6
Expanse, .....	14·8

*Loc.* Nicobar Islands.

*ASELLIA STOLICZKANA*, Dobson, pl. xx, fig. 1.

Muzzle obtuse ; ears nearly as broad as long, with acutely pointed tips ; inner margin convex, becoming slightly concave towards the tip ; outer edge doubly emarginate immediately below the tip, then becoming very convex and almost meeting the inner margin at the base ; the upper emargination is very small and shallow, and may be said to be formed by a slight projection on the side of the lower emargination, a very short distance below the tip.

Front edge of the horse-shoe portion of the nose-leaf raised, bent up in the middle, and separated from the lip by an underlying fold of membrane; on each side of the horse-shoe a double fold of membrane; upper transverse nose-leaf large, erect: upper portion, or crest, convex in front, overhanging the base which is concave, and divided into four shallow cells by three longitudinal folds; the form of the crest is that of an isosceles triangle with an obtuse vertical angle; the apex of this triangle is divided into three points by two narrow perpendicular incisions extending half way to the base, the extremities of which are attached to the membrane forming the horse-shoe by a vertical band on either side.

Behind the upper erect nose—leaf on either side, above the eyes, a wart-like prominence is placed, having on its summit the openings of two minute pores from around which long straight hairs arise.

Wings broad, wing membrane attached to lower part of ankles; thumb moderate; terminal phalanges of third and fourth fingers bifid at their extremities, each division nearly one-sixth of an inch in length, or longer than any observed by the writer in the largest *Rhinolophine* bats. Tail of six joints, last two vertebræ free.

The body is covered with long, silky fur; above bi-coloured, pure white at the base, and for two-thirds its length, the remaining portion purplish-brown; beneath dirty white throughout. Cutaneous system pure white.

On the upper surface the wings and interfemoral membranes are completely devoid of hair with the exception of a very narrow portion along the sides of the body and at the root of the tail on which the fur of the back extends; beneath, the wing membrane, as far as a line drawn from the elbow to the knee joint, is covered with short hairs, ranged along the parallel lines with which it is marked in this region; behind, the fur of the abdomen passes on to the interfemoral membrane, occupying about one-third of its surface.

The bones of the extremities are extremely slender and light, and the membranes so translucent, that letters of small type can be distinguished through them even when dry.

Teeth very small, and acutely pointed; upper canines with a small cusp at the base, both in front and behind.

Dentition.—In.  $\frac{2}{4}$ ; c.  $\frac{1-1}{1-1}$ ; p.m.  $\frac{1-1}{2-2}$ ; m.  $\frac{3-3}{3-3}$ .

	Inches
Length, head and body,.....	1·6
„ tail,.....	1·2
„ head, .....	0·6
„ ear, .....	0·4
Breadth, ditto,.....	0·35
Width, upper transverse nose-leaf, .....	0·3
Height, ditto ditto, .....	0·2
Length, forearm,.....	1·52
„ thumb, .....	0·2
„ second finger, ..	2·6
„ fourth ditto, .....	1·8
„ tibia, .....	0·68
„ foot and claws, ..	0·3
„ calcaneum, ..	0·3
Expense, .....	9·0

*Loc.* Penang.

#### MINIOPTERIS AUSTRALIS, Tomes.

Mr. Tomes in describing this species writes—“The fur too of the under-parts encroaches somewhat on the membranes, whilst in *M. blepotis*, the latter are quite free from fur.”—As this appears to me the most important point of difference amongst those enumerated, I think it would have been well, if Mr. Tomes had shown to what extent the fur of the body encroaches on the membranes, as the expression “encroaches somewhat” is vague, there being very few of the *Vespertilionidæ*, (indeed, I have never seen any, except immature individuals,) in which the fur of the body does not extend to some degree, however limited, on the wing and interfemoral membranes. I think, therefore, an accurate description of the distribution of the fur, accompanied with detailed measurements of the three specimens, obtained by Dr. Stoliczka at the Nicobars, may not be out of place here, more especially as doubts may be entertained as to the identity of this species with that described by Mr. Tomes from its remarkable distribution, to which I have referred in the Proceedings, Asiatic Society of Bengal.*

The following is a description of the colour and distribution of the fur taken from one of the three specimens dried from spirit.

* May, 1871.

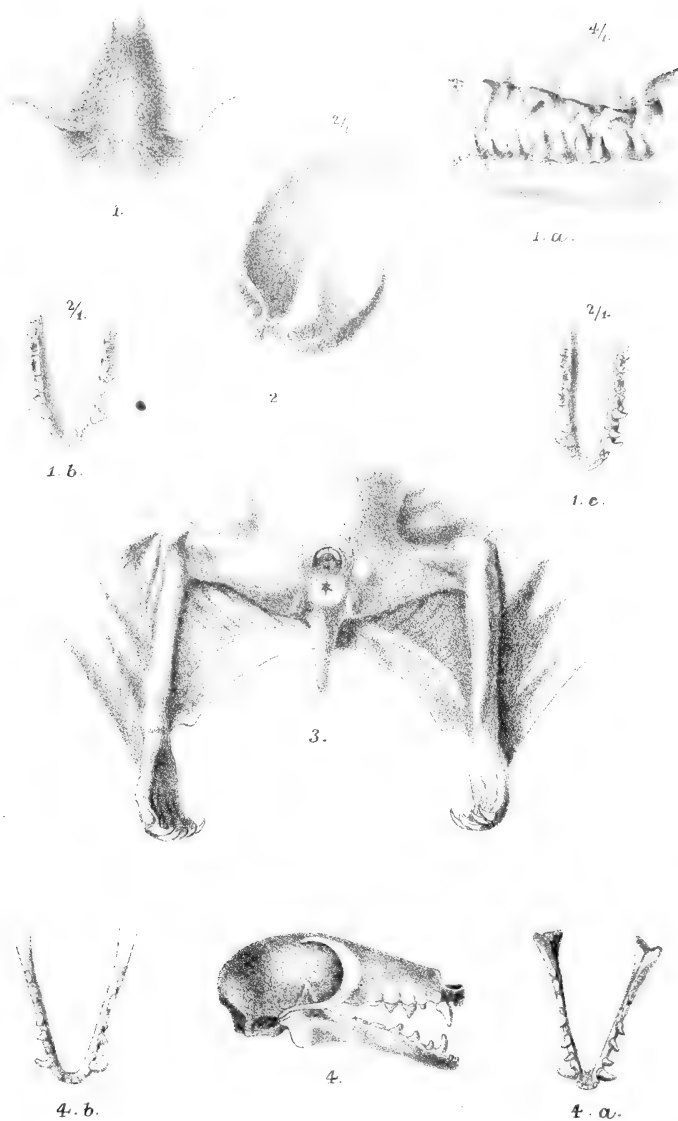
Above, uni-coloured, dark brown throughout; beneath, a lighter shade of same colour. The fur of the back extends upon the base of the interfemoral membrane as far as the end of the third caudal vertebra, densely at the root of the tail but quickly thinning out into a few scattered hairs at its termination; the femurs are thickly covered with hair for three-fourths their length, and a few short hairs appear on the backs of the toes; the head of the humerus only is covered, and laterally the extent of fur upon the wing-membrane is limited to a narrow portion along the sides of the body. Beneath, the distal two-thirds of the humerus is naked as above, but the wing membrane is covered as far as a line drawn from the middle of the humerus to the knee-joint, a narrow line of very fine short fur also extends from the elbow along the posterior margin of the forearm to the carpus; the femurs are densely covered with hair for their entire length, and the fur of the abdomen extends upon the interfemoral membrane for nearly the same distance as on the upper surface.

Of the four columns of measurements given below, Nos. 1, 2, and 3 are of three adult male specimens from the Nicobars, the fourth,—No. 1 *a*, is taken from the table of dimensions given by Mr. Tomes in the *Ann. and Mag. Nat. Hist.*, 1858, vol. II, p. 160, corresponding to No. 1 in that table, the lines being reduced to tenths of an inch.

The only differences of any account in the measurements are in those of the head and feet; the first is most probably due to the difficulty in obtaining a correct measurement of the skull when a skeleton of the specimen cannot be made, so that scarcely any two persons will give the same dimensions; the latter may be explained by supposing that Mr. Tomes, in measuring the feet took into account the curvature of the claws.

The similarity in measurement is very remarkable when we consider the great distance of the two localities — Australia and the Nicobar Islands — from each other, as we rarely find specimens of the same species from different parts of the same country agreeing so closely.

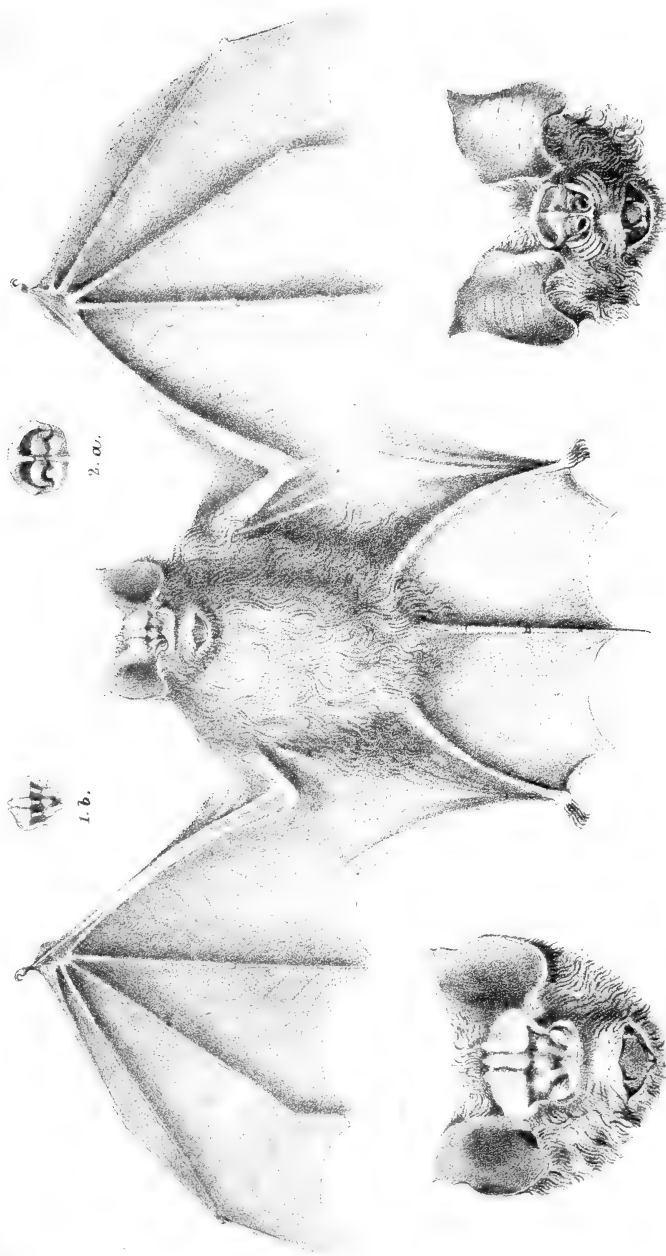




1-2. *Vespertilio auratus*, p. 186. & 267.

3-4. *Macroglossus spelæus*, p. 261. & 267.





1-1. a. 1. b. *Asellia Stoliczkae*, p. 263. 2-2. a. *Phyllorhina Nicobarensis*, p. 262.



	1	2	3	1 α.
	inches.	in.	in.	in.
Length, head and body, .....	1·85	1·8	1·85	1·9
„ tail, .....	1·85	1·85	1·85	1·8
„ head, .....	0·6	0·63	0·6	0·66
„ ear *(anteriorly), .....	0·4	0·4	0·4	„
„ ear (posteriorly), .....	0·25	0·25	0·25	0·25
„ tragus, .....	0·2	0·2	0·2	0·2
„ forearm, .....	1·5	1·5	1·5	1·58
„ thumb, .....	0·25	0·22	0·2	„
„ metacarpal bone of 2nd finger, .	1·3	1·35	1·35	} 3·0
„ first phalanx, ditto ditto, .....	0·35	0·35	0·38	
„ second, ditto ditto, .....	1·3	1·35	1·3	
„ metacarpal bone of 3rd finger, .	1·25	1·3	1·3	„
„ first phalanx, ditto ditto, .....	0·3	0·3	0·3	„
„ second, ditto ditto, .....	0·6	0·65	0·6	„
„ metacarpal bone of 4th finger, .	1·2	1·25	1·25	} 1·8
„ first phalanx, ditto ditto, .....	0·3	0·3	0·3	
„ second, ditto ditto, .....	0·3	0·3	0·3	
„ tibia, .....	0·6	0·6	0·6	0·58
„ calcaneum, .....	0·5	0·45	0·5	„
„ foot and claws, .....	0·3	0·32	0·32	0·39
Expanse, .....	11·7	11·8	11·6	11·6

* In measuring the ear I place one point of the compass at the tip, and the other at the termination of the outer margin of the ear, whether it terminates as in *Murina swillus* at the base of the tragus, or is carried forwards to the angle of the mouth, as in *Miniopterus Australis*. This I do for the sake of obtaining fixed points for measuring from in all cases, and also for the purpose of getting the actual diameter of the external ear.

The length of the head and body is obtained by measuring from the tip of the nose (the head being fully extended) to the posterior margin of the anus. For the purposes of comparison I have, in this case, determined the expanse of wings by Mr. Tomes's method which see under his description of *Miniopterus Australis*, loc. cit.

### Explanation of plates.

#### Plate X.

- Fig. 1. Head of *Vespertilio auratus*, see p. 186.  
 „ 1a, side view of upper and lower jaws, 1b, upper, and 1c, lower jaw, (all enlarged).  
 „ 2. Ear of *V. auratus*, (enlarged).  
 „ 3. Lower portion of body of *M. spelæus*, p. 261.  
 „ 4. Skull of ditto  
 „ 4a, 4b. Upper and lower jaws, of ditto.

#### Plate XX.

- Fig. 1. Head of *Phyllorhina Nicobarensis*, p. 262.  
 „ 2. Upper portion of nose leaf turned backward showing cells beneath.  
 „ 3. *Asellia Stoliczkan* (natural size), p. 263.  
 „ 4. ditto head, (enlarged).  
 „ 5. Concave base of upper transverse nose-leaf, showing the longitudinal folds and cells.

LIST OF BIRDS COLLECTED OR OBSERVED IN THE WARDHA VALLEY  
AND ITS VICINITY NEAR CHÁ'NDA,—

by W. T. BLANFORD, F. G. S.—C. M. Z. S.

[Received 14th April, 1871.]

The following list is far from complete. It is founded on collections and observations made during the greater part of two cold seasons, and of one hot one spent in the Wardha valley and its immediate neighbourhood. I was in hopes of returning to the district and adding to the list by procuring a larger number of the *Raptors*, *Grallatores* and *Natatores*, especially the two latter, to which I have paid very little attention, but as this is at present improbable, I give the list as it stands; first, because it contains, I believe, most of the birds of which the distribution within India is important, and which are common in the neighbourhood of Chánda, and secondly, because the portion of the Wardha valley in which my collections were made is a country of considerable interest in reference to this question of distribution, it being a spot where northern and southern forms are equally abundant, and close to the boundaries of three of the subdivisions into which I believe that the fauna of India proper may be divided.*

The tract of country in which I had opportunities of collecting comprises both banks of the Wardha and its tributary the Pem Ganga, and consists politically of part of Chánda district in the Central Provinces, of South East Berar, and a small tract of the Hyderabad territory. I have included all the birds found in the Chánda district between the Wardha and Wain Ganga. A strip of land varying from a few hundred yards to about 10 miles in width on each side of the river Wardha is open and for the most part cultivated, beyond this the greater portion of the country is covered with forest jungle. To the west in Berar, this jungle, resting upon trap, or on the limestones and shales of the Vindhyan series for the most part, is in general low and scattered, but still consisting principally of trees, not of mere bushes. On the east or Chánda side of the Wardha, where the rock is principally sandstone, the trees

* See J. A. S. B. 1870, Vol. XXXIX, pt. II, p. 336.

are larger and the undergrowth closer. Owing to the jungle being denser in this direction, a few forest birds are found which are common in the great wooded region to the eastward, but which do not appear to extend west of the Wardha.

The character of a district's fauna as compared with that of other parts of the country is determined quite as much by the forms which are wanting as by those which are present. I will, therefore, notice a few of the birds which are "conspicuous by their absence" in the Chánda country.

Amongst the *Raptores*, Falcons are decidedly scarce, but I have no doubt that my list is far from complete. I can scarcely believe that *Aquila imperialis*, *A. naxia*, *A. pennata* and *Eutolmaëtus Bonellii* are all wanting, perhaps all may occur occasionally, but they are certainly not common, and I could scarcely have overlooked *Spizaëtus cirrhatus* or *Circaëtus Gallicus*, had either of them been of frequent occurrence. I have never, so far as I know, seen a *Buteo*. Amongst the Owls I have not observed *Strix Indica*, nor *Athene radiata*, both however may very possibly occur; and *Ascalaphia coromanda* is either absent, or it has escaped my notice.

I have never seen *Acanthylis sylvatica* nor *Cypselus melba*, both of which I have observed and shot further to the eastward. It is singular that I should have met with only two kinds of nightjar, but although I have often looked for others, it has been without success. Several forest birds which are common on the Godávári below Sironcha and also in the forests around Raipúr do not appear to be found near Chánda. Amongst these are *Hydrocissa coronata*, *Pericrocotus speciosus* and *Edolius paradiseus*, and, so far as I have seen, *Pitta Bengalensis*.

*Malacocircus griseus* does not appear to extend so far to the north as the Chánda district, though it is common on the lower Godávári. *Otocompsa fuscicaudata* is also wanting, and I have never seen *Cittacincla macroura*. No species of *Saxicola* has been observed, nor has *Sturnopastor contra*.

Amongst the pigeons neither *Osmotreron*, *Carpophaga** nor *Chalcophaps* appear to be found. Amongst waders *Charadrius lon-*

* *C. sylvatica* is common 50 miles further to the south and throughout the Godávári valley below Sironcha.

*gipes*, *Gallinago stenura*, and *Falcinellus igneus** are wanting. I have never seen *Anser Indicus*, although it occurs occasionally both at Nágpúr and on the Godávári and Pelicans seem to be remarkably scarce.

I have prefixed the numbers from Jerdon's *Birds of India* to each species, the names used are of course different in several instances. Where no number is affixed, the species is not described in Jerdon's work.

No. 2. *Vultur calvus*.

5. *Gyps Bengalensis* : *G. indicus* probably occurs also.

6. *Neophron percnopterus*.

11. *Falco jugger*, not common.

16. *Lithofalco chicquera*, not common.

17. *Tinnunculus alaudarius*.

23. *Micronisus badius*.

24. *Accipiter nisus*, rare.

29. *Aquila fulvescens*, not uncommon.

*Spilornis spilogaster*, common in wooded parts of the country, on the banks of streams.

40. *Pandion haliaetus*, not often seen.

48. *Poliornis teesa*.

51. *Circus Swainsoni*.

52. *C. cineraceus*.

54. *C. æruginosus*.

55. *Haliastur indus*, not common.

56. *Milvus govinda*.

*M. major*, rare.

57. *Pernis cristata*.

59. *Elanus melanopterus*.

65. *Bulaca ocellata*. I shot *Otus brachyotus* in Nágpúr just outside the Chanda district, but I have not met with it within the latter.

69. *Ascalaphia Bengalensis*.

72. *Ketupa Ceylonensis*.

* I only mention this bird because Jerdon speaks of it as found throughout India. I have never seen it myself in Central or Western India, and the only places where I have met with it are in Lower Bengal and Orissa.



- 76. *Athene brama*.
- 81. *Ninox scutellatus*, rare.
- 82. *Hirundo rustica*.
- 84. *H. filifera*.
- 85. *H. erythropygia*.
- 86. *H. fluvicola*, not common; I know of but two places on  
the Wardha river where nests occur.
- 89. *Cotyle Sinensis*, local and not common.
- 90. *C. concolor*, local.
- 91. *C. rupestris*, only seen at one spot.
- 100. *Cypelus affinis*, local.
- 102. *C. Batassiensis*, ditto.
- 104. *Dendrochelidon coronata*.
- 112. *Caprimulgus Asiaticus*, not very common.
- 114. *C. monticolus*, very common in all wooded parts of the  
country.
- 117. *Merops viridis*. I have shot *M. Philippensis* a few miles  
South of the Chánda district on the Pranhita river,  
but I have not observed it in the neighbourhood of  
the Wardha.
- 123. *Coracias Indica*.
- 127. *Halcyon leucocephalus*, rare.
- 129. *H. Smyrnensis*.
- 134. *Alcedo Bengalensis*.
- 136. *Ceryle rudis*.
- 144. *Meniceros bicornis*, not common. I have never seen any  
of the larger black and white hornbills.
- 148. *Palæornis torquata*.
- 149. *P. rosa*.
- 160. *Picus Mahrattensis*.
- 164. *Yungipicus Hardwickii*.  
*Chrysocolaptes Delesserti*, very rare.
- 180. *Brachypternus aurantius*.
- 188. *Yunx torquilla*, not common.
- 197. *Xantholæma Indica*. I am nearly certain that I have  
heard a *Megalæma*, but I have not shot it.
- 205. *Hierococyx varius*. I have seen and shot *Cuculus canorus*

in Ahiri, not more than 20 miles south of the Chánda district, and I have no doubt but that it occurs occasionally in the forests east of Chánda.

208. *Otolygon nigrum*, very rare. I believe that *Eudynamys honoratus* occurs, but it is far less common than to the eastward, and I have not shot it.
217. *Centropus rufipennis*.
222. *Taccocua affinis*.
232. *Leptocoma Zeylonica*, not common.
234. *Arachnechthra Asiatica*.
238. *Dicæum minimum*, this and the next species were only observed east of the Wardha. Neither is common.
240. *Piprisoma agile*.
246. *Salpornis spilonota*, rare, only seen south-east of Chánda.
250. *Sitta castaneiventris*, scarce.
255. *Upupa Ceylonensis*.
256. *Lanius lahtora*.
257. *L. caniceps*, i. e., the southern variety or race, but intermediate forms between this and *L. erythronotus* occur in the northern part of the area.
260. *L. vittatus*.
265. *Tephrodornis Pondiceriana*.
270. *Grauculus Macei*.
276. *Pericrocotus peregrinus*.
277. *P. erythropygius*, only seen west of the Wardha, in S. E. Berar, and there not often.
278. *Dicrurus macrocerus*.
281. *D. cærulescens*.
287. *Artamus fuscus*, rare and local.
288. *Tchitrea paradisi*.
290. *Myiagra azurea*, rare, and only seen in the forest east of Chánda.
292. *Leucocerca aureola*.
293. *L. leucogaster*, rare.
295. *Cryptolopha cinereocapilla*.
297. *Alseonax latirostris*, rare.
301. *Eumyias melanops*, not common.

305. *Cyornis Jerdoni*, very rare.  
306. *C. Tickelliae*, rare.  
310. *Muscicapula superciliaris*, very rare.  
*Erythrosterna parva*.  
325. *E. acornaus*, very rare.  
351. *Petrocossyphus cyaneus*.  
353. *Oreocates cinclorhynchus*, rare, only seen south-east of Chánda.  
354. *Geocichla cyanota*, only observed east of the Wardha.  
385. *Pycutorhis Sinensis*.  
397. *Dumetia hyperythra*.  
434. *Malacocircus Malabaricus*.  
436. *M. Malcolmii*, rare east of the Wardha, and not seen east or south of Chánda.  
438. *Chatorhea caudata*.  
452. *Ixos luteolus*, rare, only seen near Chánda.  
462. *Pycnonotus pusillus*.  
463. *Phyllornis Jerdoni*.  
467. *Iora zeylonica*.  
470. *Oriolus kundoo*.  
472. *O. melanocephalus*, only seen east of Chánda.  
475. *Copsychus saularis*.  
480. *Thamnobia Cambayensis*.  
481. *Pratincola caprata*.  
483. *P. indica*.  
497. *Ruticilla rufiventris*.  
514. *Cyanecula suecica*.  
515. *Acrocephalus brunnescens*.  
516. *A. dumetorum*.  
517. *A. palustris*, local.  
520. *Locustella Hendersoni*, rare, only once met with.  
530. *Orthotomus longicauda*.  
534. *Prinia socialis*, very rare, and only observed west of the Wardha.  
536. *P. gracilis*.  
539. *Cisticola schænicola*.  
543. *Drymoica inornata*.

546. *Drymoica neglecta*.  
553. *Phyllopneusterama* (*P. caligata*, Licht., teste Tristram).  
*Calamodyta agricolensis*.  
560. *Phylloscopus viridanus*, this is the only species which is common, but one or two others must occur. I have shot *P. tristis* and *P. nitidus* in adjoining districts.  
562. *P. indicus*.  
581. *Sylvia orphea*.  
582. *S. affinis*.  
589. *Motacilla Maderaspatana*.  
591. *M. personata*.  
*M. dukhunensis*.  
592. *M. sulphurea*.  
593. *Budytes flavus*, var. *melanocephalus*.  
594. *B. citreolus*.  
597. *Pipastes arboreus*.  
600. *Corydalla rufula*.  
602. *Agrodroma campestris*.  
645. *Parus cinereus*. I have shot *Zosterops palpebrosus*, a few miles farther south on the Pranhita.  
648. *Machlolophus Jerdoni*, rare.  
660. *Corvus culminatus*.  
663. *C. splendens*.  
674. *Dendrocitta rufa*.  
684. *Acridotheres tristis*.  
687. *Temenuchus pagodarum*.  
690. *Pastor roseus*.  
694. *Ploceus baya*.  
699. *Munia undulata*.  
703. *M. malabarica*.  
704. *Estrela amandava*.  
705. *E. formosa*, only found east of the Wardha, and very local.  
706. *Passer indicus*.  
711. *P. flavicollis*.  
716. *Emberiza Huttoni*, rare, and only seen west of the Wardha.

721. *Euspiza melanocephala*. *E. luteola*, which is by far the most abundant species about Nágpur, is certainly rare near Chánda, and I am not sure that I have seen it.
724. *Melophus melanicterus*, very rare.
738. *Carpodacus erythrínus*.
756. *Mirafra erythroptera*.
757. *M. cantillans*, rare and local.
758. *Ammomanes phænicura*.
760. *Pyrrhulauda grisea*.
761. *Calandrella brachydactyla*.
767. *Alauda gulgula*.
773. *Crocopus chlorigaster*.
788. *Columba intermedia*.
794. *Turtur Cambayensis*.
795. *T. Suratensis*.
796. *T. risorius*.
797. *T. humilis*.
800. *Pterocles fasciatus*.
802. *Pt. exustus*.
803. *Pavo cristatus*.
813. *Gallus Sonneratii*.
814. *Galloperdix spadiceus*. I insert this bird on the authority of my friend Mr. Hughes. It must occur, and very probably *G. lunulosus* also occasionally, but I do not recollect having seen either myself.
819. *Francolinus pictus*.
822. *Ortygiornis Pondiceriana*.
827. *Perdicula asiatica*.
828. *P. erythrohyncha*, rare.
829. *Coturnix communis*.
830. *C. Coromandelica*.
834. *Turnix Dussumieri*.
836. *Eupodotis Edwardsii*, local.
839. *Sypheotides auritus*, rare.
840. *Cursorius Coromandelicus*.
849. *Ægialitis Curonicus*.
855. *Lobivanellus Goensis*.

856. *Sarciophorus bilobus*.  
857. *Hoplopterus Malabaricus*.  
858. *Esacus recurvirostris*. *Edicnemus crepitans* must occur,  
but I have not observed it.  
863. *Grus antigone*.  
865. *G. cinerea*. I have not seen *G. virgo*, although it doubtless  
occurs, but cranes are not nearly so common, even on  
the river banks, as they are a little farther to the  
north.  
871. *Gallinago scolopacinus*.  
872. *G. gallinula*, I have not collected *Rhynchaea Bengalensis*,  
but it must occur.  
880. *Philomachus pugnax*.  
884. *Tringa damacensis*.  
885. *T. Temminckii*.  
891. *Actitis glareola*.  
892. *A. ochropus*.  
894. *Totanus glottis*. I must here repeat that the list of waders  
is very imperfect. All the species of sandpipers, green-  
shanks, &c., probably occur.  
•  
898. *Himantopus candidus*.  
900. *Metopidius indicus*. I believe *Hydrophasianus Sinensis* also  
occurs.  
902. *Porphyrion poliocephalus*.  
907. *Gallinula phanicura*. Other species of water hens and  
several kinds of rails should doubtless be added to  
this list.  
916. *Leptoptilos javanicus*.  
920. *Ciconia episcopus*.  
923. *Ardea cinerea*.  
924. *A. purpurea*.  
925. *Herodias alba*.  
927. *H. garzetta*.  
930. *Ardeola leucoptera*.  
931. *Butorides Javanica*.  
938. *Tantalus leucocephalus*.  
940. *Anastomus oscitans*.

942. *Geronticus papillosus*.  
 944. *Phænicopterus antiquorum*, very rare.  
 950. *Sarcidiornis melanonota*.  
 951. *Nettapus Coromandelianus*.  
 952. *Dendrocygna arcuata*.  
 954. *Casarca rutila*.  
 961. *Chaulelasmus streperus*; and doubtless all the other common migratory ducks, but from the nature of the tanks, it is unusually difficult to get at them, and I have shot none except the gadwall and the following:  
 964. *Querquedula crecca*.  
 965. *Q. circa*.  
 969. *Aythya nyroca*.  
 975. *Podiceps Philippensis*.  
 987. *Sterna javanica*. I have also, I think, seen *Seena aurantia* and one or two other species.  
 1007. *Graculus javanicus*.  
 1008. *Plotus melanogaster*.

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 MONOGRAPH OF INDIAN CYPRINIDÆ, (*Part II*)—
by Surgeon F. DAY.

[Continued from p. 143, with pl. xxi.]

Genus. CARASSIUS, Nilsson.

Abdomen rounded: mouth anterior, arched, and rather narrow, lips thin. Snout obtuse and rounded. No barbels. Pharyngeal teeth compressed and in a single series, 4/4. Dorsal fin long, commencing opposite the ventrals and having its last undivided ray osseous and serrated: last undivided anal ray osseous and normally serrated. Scales of moderate size. Lateral line complete to the centre of the base of the caudal fin.

Geographical distribution. Temperate portions of Europe and Asia; having been domesticated it has degenerated into numerous varieties.

Synopsis of species.

1. *Carassius auratus*, D. $\frac{3}{16-18}$, A. $\frac{3}{5}$. From rifle green to silver or orange colours. *Upper Burma, Bombay?*

1. *CARASSIUS AURATUS.*

Cyprinus auratus, Linn., Sys. Nat., vol. i, p. 527; Bl. Schn., p. 439; Lacép, vol. v, p. 553; Cuv. and Val., vol. xvi, p. 101; Richard, Ich. China, p. 293.

Carassius auratus, Bleeker, Atl. Ich. Cyp., p. 74; Günther, Catal., vol. vii, p. 32, (where see synonym.)

? *Cyprinus nukta*, Sykes, Trans. Zool. Soc., vol. ii, p. 355.

B. III, D. $\frac{3}{16-18}$; P. 17; V. 9; A. $\frac{3}{5}$; C. 19; L. l. 27—29;
L. tr. $\frac{6\frac{1}{2}}{10}$; Vert. 18/13.

Length of head $\frac{2}{9}$: of caudal $\frac{2}{11}$: height of body $\frac{2}{7}$: of dorsal spine $\frac{1}{6}$ of the total length.

Eyes. Diameter $\frac{1}{4}$ of length of head: $1\frac{1}{2}$ diameters from end of snout: 2 diameters apart.

Fins. Last undivided dorsal ray osseous and serrated.

Lateral line—complete, from $5\frac{1}{2}$ to $6\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. Rifle green when in the wild state.

The gold carp is too well known to require any detailed description. Colonel Sykes records having obtained a variety of it in the Deccan, but he also remarked it had "two tendrils on the lower jaw." Admitting this to be so, it could not have been this species to which, however, it has been referred by Yarrell, Rüppell, and Günther: Mr. Masters likewise sent three adult specimens from India to the British Museum, still I very much question if they were captured there in their wild state, the nearest point, where they are obtained in a state of nature, being high up in Upper Burma.

The almost endless deformities, into which this species has been bred, may be briefly defined as follows. Vertebral column only deformed: fins also abnormal, the dorsal being decreased or even absent: the anal spine double: caudal enlarged and with three or four lobes. Occasionally the eyes are protruding.

Col. Sykes observes the "Nukta" is found at Mahloongeh, 18 miles north of Poona in the Inderanee river, and that it has "two knobs or short horns on the nose between the eyes." Dr. Jerdon informs me it is not *C. auratus*, its native name at Poona is *Dotton-di*, whilst the knob is single not double.

Hab. Upper Burma.

Genus. SEMIPLLOTUS, Bleeker. Pl. xxi, fig. 1.

Abdomen rounded: mouth wide, transverse, slightly curved, inferior, with a knob at the symphysis. Snout thick and prominent. Intermaxillaries more or less adherent to the maxilla, and but slight powers of motion exist in the upper jaw. No barbels. Pharyngeal teeth (in S. modestus) 4, 3, 2/2, 3, 4. Dorsal fin long, its last undivided ray being strong, osseous, and either serrated or entire. Anal rather short. Scales large. Lateral line passing to the centre of the base of the caudal fin.

Geographical distribution. Assam and Hill ranges on the Tenasserim coast.

Synopsis of species.

A. Serrated dorsal ray.

1. *Semiplotus modestus*, D. 4/20; A. 3/6; L. l. 32—34. Last undivided dorsal ray osseous and serrated. *Akyab.*

B. Smooth dorsal ray.

2. *Semiplotus McClellandi*, D. 3/25; A. 2/7; L. l. 27. Last undivided dorsal ray osseous and entire; silvery. *Assam.*

A. Serrated dorsal ray.

1. SEMIPLLOTUS MODESTUS. Pl. xxi, fig. 1.

Day, Proc. Zool. Soc., 1870, p. 101.

B. III. D. 4/20; P. 15; V. 9; A. 3/6; C. 19; L. l. 32—34; L. tr. $7\frac{1}{2}/7\frac{1}{2}$.

Length of head 2/9: of caudal 2/9: height of body nearly 1/3 of the total length.

Eyes. Diameter 1/3 of length of head: 1 diameter from end of snout: $1\frac{1}{2}$ diameters apart.

Snout broad, obtuse, with several open pores on either side. Mouth inferior, transverse: no horny substance on the jaws, mandible not covered by the lip, a knob at the symphysis. Slight motion between the maxillary and intermaxillary bones. The posterior extremity of the maxilla extends to beneath the middle of the orbit. Barbels absent.

Teeth, pharyngeal, 4, 3, 2/2, 3, 4,

Fins.—Dorsal fin commences anterior to the origin of the ventral and extends to above the anal, its last undivided ray is osseous and serrated.

Colours.—Silvery, darkest in the upper half of the body. Ventrals and anal tipped with orange.

Hab. Hill ranges near Akyab in the Tenasserim provinces; two specimens obtained up to $5\frac{1}{2}$ inches in length.

B. *Smooth dorsal ray.*

2. SEMILOTUS M'CLELLANDII.

Cyprinus semilotus, M'Clell., Ind. Cyp., pp. 274, 346, pl. xxxvii, fig. 2. \* Cuv. and Val., vol. xvi, p. 68.

Semilotus M'Clellandii, Bleeker, Atl. Ich. Cyp., p. 25.

Sundaree and *Sentoree*, Assam.

B. III. D. $\frac{3}{25}$; P. 16; V. 10; A. $2\frac{7}{7}$; C. 19; L. 1. 27; L. tr. $6\frac{5}{5}$.

Length of head $\frac{1}{6}$: of caudal $\frac{1}{5}$: height of body $\frac{4}{17}$, according to a bad skin.

Eyes. Diameters $\frac{2}{7}$ of length of head: 1 diameter from end of snout, and 2 diameters apart.

Snout thick, prominent, with a row of pores across it.

Fins. Osseous dorsal ray, strong, smooth, its stiff portion being three quarters the length of the head.

Lateral line—rather concave.

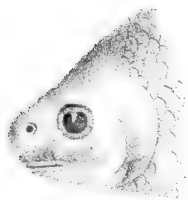
Hab. Assam.

Genus. CATLA, Cuv. and Val. Pl. xxi, fig. 2.

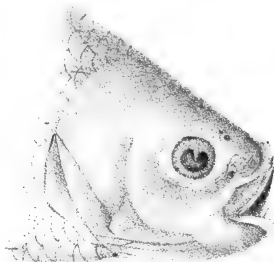
GIBELION, Heckel.

HYPSELOBARBUS, Bleeker.

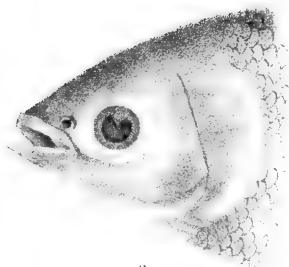
Head broad: snout with very thin integuments, and no upper lip, whilst the inferior is moderately thick, with a continuous free posterior margin. The lower jaw with a moveable articulation at the symphysis, but destitute of any prominent tubercle. No barbels. Gill rakers long, rather strong and moderately wide apart in the adult, but fine and closely set in the immature. Eyes with free orbital margins. Pharyngeal teeth plough-shaped, 5, 3, $2\frac{2}{2}$, 3, 5. Dorsal fin rather long, without osseous ray, whilst it commences somewhat in advance of the ventrals: anal short: caudal forked. Scales of moderate size, no tiled ones along the base of the anal fin. Lateral line continuous to the centre of the base of the caudal fin.



1.



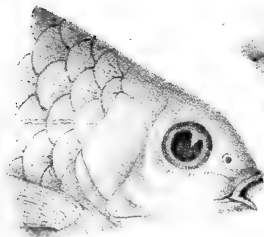
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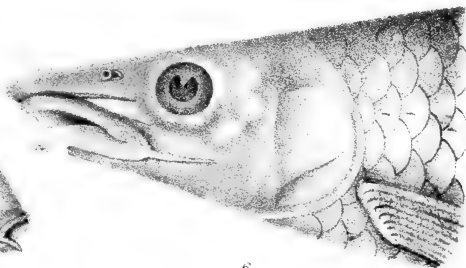
3.



5.



4.



6.

1. *Semiplotus modestus*.

2. *Calla Buchananii*.

3. *Mola harengula*.

4. *Barbus parrah*.

5. " " tor.

6. " " (variety)

Geographical distribution. This fine fish appears to be absent from Southern India; commencing to be found in the Kistna at Masulipatam it extends to the Punjáb, also the N. W. Provinces and throughout Bengal, Assam and Burma so far as the Pegu river. It is said, however, not to exist in Tenasserim. If Sykes's *Cyprinus abramioides* is this species, it is also found in the Deccan.

Synopsis of species.

1. *Catla Buchanani*. D. $\frac{3-4}{13}$; A. $\frac{3}{5}$; L. l. 40-43; L. tr. $\frac{7\frac{1}{2}}{9}$; from the Kistna through Hindústán to Pegu in Burma.

1. CATLA BUCHANANI. Pl. xxi, fig. 2.

Cyprinus catla, Ham. Buch., Fishes of Ganges, pp. 287, 318, 387, pl. 13 f. 81; McClelland, Ind. Cyp. pp. 275, 348,\* Cuv. and Val. xvi, p. 433.

Leuciscus catla, Val. in Bel. Voy. Ind. Orient. p. 379, pl. 3, f. 2.

Catla Buchanani, Cuv. and Val., xvii, p. 411. pl. 515; Bleeker, Verh. Bat. Gen., xxv. Beng. and Hind. p. 142; Günther, Catal., vii, p. 34; Day, Proc. Zool. Soc., 1869, p. 370.

? *Cyprinus abramioides*, Sykes, Trans. Zool. Soc. ii, p. 353, pl. 61, f. 2.

Hypselobarbus (Tambra) abramioides,\* Bleeker, Pro. Cyp. p. 275.

Botchee, Telugu: *Catla*, Bengal. Hind. and Punj.: *Barkur*, Ooriah: *Nga-thaing*, Burmese: *Tambra*? Hind. in Bombay: *Boassa*, Hind. in N. W. Provinces.

B. III. D $\frac{3-4}{14}$, P. 21, V. 9, A $\frac{3}{5}$, C. 19, L. l. 40-43, L. tr. $\frac{7\frac{1}{2}}{9}$, Vert. 17/18.

Length of head $\frac{1}{5}$, of base of dorsal $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{7}$, of the total length.

Eyes. Diameter $\frac{1}{6}$ of length of head: 2 diameters from end of snout: 3 diameters apart.

Body elevated.

Lower jaw longest, the posterior extremity of the upper jaw extending to below the nostrils. In large specimens some fine pores on the snout.

Teeth, pharyngeal, plough-shaped, 5, 3, $2\frac{2}{3}$, 3, 5.

Fins. Dorsal arises rather in advance of the ventral, caudal deeply lunated. Some males have the fins elongated.

Scales. From six to six and a half rows of scales between the lateral line and base of ventral fin.

Lateral line—complete to the centre of the base of the caudal fin.

Colours. Greyish above, more silvery below. Fins dark coloured, sometimes black. The colouration varies with the season and locality.

Grows to six feet in length; is much esteemed as food when up to two feet long, but when larger becomes coarse. "There is no species" observes McClelland "of more importance than this in an economic point of view. Buchanan informs us, it is light and wholesome food; the head he remarks is peculiarly delicious: this I can also answer for, and am at a loss to know why it should have been so long overlooked by our epicures."

Hab. Hindústán and the Punjáb, extending westwards to the Kistna and eastwards to the Pegu river.

It resides in brackish or fresh water, and is found within tidal influence, "but it lives and attains a great size in tanks and ponds quite unconnected with tides and currents, so that it is capable of being introduced wherever there is fresh water." (McClelland.) "It is a very strong active animal and often leaps over the seine of the fishermen, on which account when fishing for the *Catla*, they usually follow the net in canoes, and make a noise by shouting and splashing with their paddles." (Ham. Buchanan.) It is said never to take a bait, but as it rises at natural flies, it could probably be taken with artificial ones.

At Coconada exists a moderately sized tank of fresh water fed from the irrigation canal; this had not been netted for three years; at one haul 27 large fishes of this species were captured varying in size from 5 to 9 lb. each, and these were irrespective of a very large quantity of smaller fishes and younger ones of this sort. There is perhaps no carp more adapted for introducing into the Cauvery, as it could easily be sent from Masulipatam by steamer to Madras and from thence by rail to the railway station on the Madras side of Trichinopoly, and there turned direct into the Cauvery river. It is largely employed for stocking tanks, as at two years old it grows to about 10 lb. in weight.

Genus. *MOLA*, Heckel. Pl. xxi, fig. 3.

Thynnichthys, pt., Bleeker.

Amblypharyngodon, pt., Bleeker.

Brachygramma, pt. Day.

Pseudobranchiæ present. Abdomen rounded. Head compressed: integuments over snout thin: upper lip absent: only a short labial fold on the side of the mandible. Mouth rather wide, antero-lateral, with the lower jaw somewhat prominent. No barbels. Gill rakers very short or absent. Eyes in the middle of the depth of the head, and without any adipose membrane. Pharyngeal teeth molar-form, close together, 5, 3 or 4, 2 or 3/2 or 3, 4 or 3, 5: or 5 or 3, 2 or 3 or 4, 2 or 1/1 or 2, 4 or 3 or 2, 3 or 5. Dorsal fin short without osseous ray, commencing nearly opposite the ventrals: anal short. Scales small. Lateral line complete, running to the centre of the base of the caudal fin, (*Thynnichthys* Bleeker); or incomplete (*Amblypharyngodon*, Bleeker). Intestinal tract narrow, and with numerous convolutions.

Geographical distribution. Throughout the continent of India, Burma and East Indian Archipelago.

Synopsis of species.

A. Lateral line, complete. (*Thynnichthys*.)

1. *Mola harengula*, D. 3/9. A. 3/5. L. r. 120. L. tr. 22/25. Kistna and Godavery.

B. Lateral line incomplete. (*Amblypharyngodon*)

2. *Mola Buchananii*, D. 2/8. A. 2/5. L. l. 55-75. Dorsal arises opposite inner ventral ray. Orissa through Bengal to Burma.

3. *Mola melettinus*, D. 2/8. A. 2/5. L. l. 50-57. Dorsal arises behind the ventrals. Southern India.

4. *Mola Atkinsonii*, D. 3/5. A. 2/5. L. l. 55. Body deep, nearly 1/3 of the total length. Burma.

A. Lateral line complete, (*Thynnichthys*.)

1. *MOLA* (*Thynnichthys*) *HARENGULA*, pl. xxi, fig. 3.

Leuciscus harengula, Cuv. and Val., xvii, p. 303, pl. 500.

Kala-tala and *Ahku-chappah*, Tel.

B. III. D. 3/9, P. 19, V. 9, A. 3/5, C. 19, L. r. 120, L. tr. 22/25.

Length of head 1/4: of caudal 1/4: height of body 1/4: of dorsal fin 1/5 of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head: $1\frac{1}{2}$ diameters from end of snout: $1\frac{1}{2}$ diameters apart.

A small tubercle above symphysis of the lower jaw.

Teeth pharyngeal,—4, 4, $\frac{3}{3}$, 4, 4, the crowns somewhat resembling the inferior surface of a grain of wheat.

Fins. Dorsal commences above the ventral and slightly nearer the snout than the base of the caudal, which latter is forked and its lower lobe the longest.

Scales. Seventeen rows between the lateral line and the base of the ventral fin.

Colours. Silvery, head purplish.

Hab. Godavery and Kistna rivers, where it attains above a foot in length; it also breeds in tanks.

B. *Lateral line incomplete.* (*Amblypharyngodon.*)

2. *MOLA* (*Amblypharyngodon*) BUCHANANI.

Cyprinus mola, Ham. Buch., pp. 334, 392, pl. 38, f. 92; \* Cuv. and Val., xvi, p. 440.

Leuciscus mola, McClelland, Ind. Cypr., pp. 293, 407; Bleeker, Verh. Bat. Gen., Beng. en Hind., p. 140.

Leuciscus pellucidus, McClelland, l. c. pp. 293, 408.

Mola Buchanani, Blyth, J. A. S. of Beng. 1860, p. 164.

Leuciscus microlepis, Bleeker, Verh. Bat. Gen., xxv, Beng. en Hind. p. 141.

Rhodeus macrocephalus? Jerdon, M. J. L. & S. 1849, p. 324.

Amblypharyngodon mola, Bleeker, Prod. Cyp. p. 409; Günther, Catal. vii, p. 202.

Amblypharyngodon microlepis, Bleeker, l. c. p. 409.

Amblypharyngodon pellucidus, pt. Günther, l. c. p. 202.

Talla-maya, Tel.: *Morara*, Oorlah: *Moah*, Assam: *Mukni*, Punj.: *Nga-beh-byoo* and *Nga-zen-zap*, Burmese.

B. III. D. $\frac{2}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1, 55-75, L. tr. 25/28.

Length of head from $\frac{1}{4}$ to $\frac{2}{9}$: height of body from $\frac{1}{4}$ to $\frac{1}{5}$ of the total length; but the relative proportions vary much in different localities.

Fins. The origin of the dorsal arises in a line with the inner ventral ray.

Scales. The numbers are subject to a wide variation.

Colours. A silvery band along the middle of the side.

Hab. Orissa, Bengal, N. W. Provinces, Punjáb, Assam, and Burma, rarely attaining above 4 inches in length.

3. *MOLA (Amblypharyngodon) MELETTINUS.*

Leuciscus melettinus, Cuv. and Val., XVII, p. 304, pl. 501.

? „ *sandkhol* and *chitul*, Sykes, T. Z. S. ii, p. 363.

Rhodeus Indicus, Jerdon M. J. L. and S., 1849, p. 324.

Brachygramma Jerdoni, Day, Proc. Zool. Soc. 1865, p. 304.

Amblypharyngodon Jerdoni, Day, Fishes of Malabar, p. 217, pl. 17, f. 1.

„ *melettinus*, Günther, Catal. vii, p. 202.

Wumboo, Mal.; *Oolaree*, Tam.; *Kali-korafi*, Hind.; *Paraga*, Can. *Muckni*, Punj.

B. III. D $\frac{2-3}{7}$, P. 15, V. 9, A. $\frac{2-3}{5}$, C. 19, L. 1. 50-57.

Length of head $\frac{1}{5}$: of caudal $\frac{1}{5}$: height of body $\frac{1}{4}$ of the total length.

Fins. The origin of the dorsal is behind the root of the ventral.

Colour. A silvery band along the side.

Hab. Southern India and the Western coast, rarely reaching 4 inches in length.

4. *MOLA (Amblypharyngodon) ATKINSONII.*

Mola Atkinsonii, Blyth, J. A. S. of Beng., 1861, p. 164.

Nga-pan-ma Burmese.

B. III, D. $\frac{3}{5}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 55, L. tr. 11/11.

Length of head $\frac{1}{4}$: of caudal $\frac{1}{5}$: height of body nearly $\frac{1}{3}$ of the total length.

Eyes. 1 diameter from end of snout.

Fins. Dorsal commences midway between the anterior margin of the orbit and the base of the caudal fin.

Lateral line—ceases after 19 scales, there are six rows between it and the base of the ventral fin.

Hab. Burma. This is the deepest and largest of the species of this genus which have an incomplete lateral line. It is frequently obtained 6 inches in length.

Genus.—*BARBUS*, Cuv. and Val. Pl. xxi. figs. 4-6.

Puntius, pt. Ham. Buch.

Labeobarbus, *Varicorhinus*, pt. Rüpp.

Systemus, pt. McClell.

Capoëta, sp. Cuv. and Val.

Pseudobarbus, Bielz.

Luciobarbus, Heckel.

Cheilobarbus, sp. Smith.

Balantiocheilus, *Hemibarbus*, *Cyclocheilichthys*, *Siaja*, *Anemathichthys*, *Hypselobarbus*, *Gonoproktopterus*, *Gnathopogon*, *Hampala*, sp. Bleeker.

Enteromius, sp. Cope.

Mouth arched, jaws closely invested by the lips which may have leathery lobes, but no inner fold or horny covering. *Barbels* four (*Barbodes*, Bleeker.): or two (*Capoëta*, Cuv. and Val.): or none (*Puntius*, H. Buch.). *Eyes* without adipose lids. *Pharyngeal teeth* 5 or 4, 3 or 4, 2 or 3/2 or 3, 3 or 4, 4 or 5. *Dorsal fin* rather short, its last undivided ray being either ossified and serrated or entire, or articulated and not osseous; it commences nearly opposite the root of the ventrals: anal rather short, in some species its second ray ossified. *Scales* large, of moderate or small size: anal scales not enlarged. *Lateral line* complete, or incomplete, when the former continued to opposite the centre of the base of the caudal fin.

This most extensive genus has been subdivided by various authors into numerous genera and sub-genera, but, passing gradually one into another, they have in the majority of instances failed to be permanently accepted. The three sub-genera of those with 4, 2, or 0 barbels is useful and apparently correct, for the occasional abnormal absence of one or more of these appendages in fish which are so extensively kept in an artificial state in tanks, does not appear sufficient reason why such natural subdivisions should be excluded from ichthyological systems. It is likewise remarkable that nearly all forming the sub-genus *Barbodes*, provided they are soberly coloured, and either have or are deficient in the lateral blotch, grow to a large size: the brilliant coloured ones are mostly residents of mountain streams, or of rivers contiguous to hills and they are generally small. Those of the sub-genus, *Capoëta*,

never grow to the size attained by the *Barbodes*: some, more especially when residing in mountain streams, have a vivid colouration. The species of the sub-genus *Puntius* are mostly of small size, whilst a few are brilliantly coloured. Amongst these sub-genera a most natural subdivision appears to be into those with the last undivided dorsal ray osseous and serrated or smooth, or others in which the bony element is absent: whilst even further subdivisions, are easily made, if desired, into whether the fin rays are elongated, and the lateral line is complete or incomplete.

Geographical distribution. Representatives of this genus exist in most, if not all, Indian and Burmese rivers and tanks, the larger species being generally termed Mahseers. Some attain an enormous size as 90 lb. and upwards, these are more residents in rivers along the bases of hills or large rapids, but a few have even a more extended range. In an economic point of view, this genus is very valuable as food, whilst owing to the extensive range of some, it appears, that considerable variations occur which have been defined as separate species.

SYNOPSIS OF SPECIES.

A. *With four barbels, (Barbodes.)*

a. *Last undivided dorsal ray, osseous and serrated.*

1. *Barbus chagunio*, D. 3/8. A. 3/5. L. 1. 44-47. Pores on snout and head. Colours uniform. *Orissa, Bengal and Behar.*

2.\* *Barbus clavatus*, D. 11. A. 8. L. 1. 42. Pores on snout. Colours uniform, *Sikkim.*

3. *Barbus immaculatus*, D. 3/8. A. 3/5. L. 1. 32-33. No pores on snout. Colours uniform. *Bengal, Assam, Sikkim, N. W. Provinces.*

4. *Barbus sarana*, D. $\frac{3-4}{8}$. A. 3/5. L. 1. 29-31. Colours uniform. Caudal stained in Burma. *India, Ceylon and Burma.*

5. *Barbus pinnauratus*, D. 3/8. A. 2/6. L. 1. 27-29. A black lateral blotch, fins orange. *Indus, Bombay, Kurnool, Malabar.*

6. *Barbus pleurotænia*, D. 3/8. A. 2/6. L. 1. 28. A black band from eye to middle of tail. *Ceylon.*

7. *Barbus goniosoma*, D. 3/8. A. 2/5. L. 1. 24. Serrated dorsal ray weak. Colours uniform. *Mergui.*

8.\* *Barbus roseipinnis*, D. 3/8. A. 2/5. L. 1. 22. Caudal, anal and ventrals red. *Pondicherry.*

9.\* *Barbus rodactylus*. Fins red. *Assam.*

b. *Last undivided dorsal ray, osseous and entire.*

10. *Barbus dubius*, D. 4/9. A. 2/5. L. 1. 42. No pores on snout. 5 rows of scales between l. 1. and base of ventral fin. Dorsal spine strong. *Madras.*
11. *Barbus Mysorensis*, D. 4/9. A. $\frac{2-3}{5}$. L. 1. 40. Dorsal spine strong, 3 rows of scales, between l. 1. and base of ventral fin. *Mysore, Madras, and Western coast.*
12. *Barbus Carnaticus*, D. 4/8. A. $\frac{2-3}{5}$. L. 1. 30-32. Dorsal spine strong. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Madras and Western coast.*
13. *Barbus Jerdoni*, D. 3/9. A. 3/5. L. 1. 28. Dorsal spine weak, 4 rows of scales between l. 1. and base of ventral fin. *Canara.*
14. *Barbus hexastichus*, D. $\frac{3-4}{9}$. A. $\frac{2}{5-6}$. L. 1. 25-27. Dorsal spine strong. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Himalayas, Cashmere, Sikkim.*
15. *Barbus mosal*, D. $\frac{3}{9}$. A. $\frac{2-3}{5}$. L. 1. 25-27. Dorsal spine strong, no lobed lips, $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Hilly regions of India.*
16. *Barbus tor*, D. 3/9. A. 2/5. L. 1. 23-27. Dorsal spine strong. Upper jaw longest, lips lobed. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Rapids throughout India.*
17. *Barbus sophore*, D. 3/9. A. 2/5. L. 1. 25. Dorsal spine weak, $2\frac{3}{4}$ rows of scales between l. 1. and base of ventral fin. *Bengal.*
18. *Barbus innominatus*, D. 3/9. A. 2/5. L. 1. 24. Dorsal spine weak, 3 rows of scales between l. 1. and base of ventral fin. *Ceylon.*
19. *Barbus Neilli*, D. 4/9. A. 3/5. L. 1. 24-26. Dorsal spine weak. $4\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Kurnool in Madras.*
20. *Barbus compressus*, D. 3/9. A. 3/5. L. 1. 22. Dorsal spine weak. $3\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Cashmere?*
21. *Barbus micropogon*, D. 2/8. A. 3/5. L. 1. 38. Dorsal spine weak. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Assam?*
22. *Barbus chilinoides*, D. $\frac{3-4}{7}$. A. 2/5. L. 1. 32-35. Dorsal spine strong. 3 rows of scales between l. 1. and base of ventral fin. *Ganges and Himalyas.*
23. *Barbus Stracheyi*, D. 2/9. A. 2/5. L. 1. 23. Dorsal spine strong. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Tenasserim and Burma.*

c. *No osseous dorsal ray.*

24. *Barbus pulchellus*, D. 4/9. A. 3/6. L. 1. 30. 4 rows of scales between l. 1. and base of ventral fins, upper half of body, dark coloured. *Canara.*
- 25.\* *Barbus spinulosus*, D. 3/9. A. 2/5. L. 1. 32. *Sikkim.*

26. *Barbus Stevensonii*, D. 3/9. A. $3\frac{3}{5}$. L. 1. 27. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Akyab.*
27. *Barbus Blythii*, D. 3/9. A. $3\frac{3}{5}$. L. 1. 22. $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Tenasserim.*
28. *Barbus melanampyx*, D. 3/8, A. $2\frac{2}{5}$ L. 1. 20, 2 rows of scales between l. 1. and base of ventral fin. Red with three vertical black bands. *Rivers along Western Ghats.*

B. *With two barbels (Capota).*

a. *With osseous serrated dorsal ray.*

29. *Barbus hampal*. D. 4/8. A. $2\frac{2}{6}$, L. 1. 26, $3\frac{1}{2}$ rows of scales between l. 1. and base of ventral. *Tavoy.*

b. *Osseous dorsal ray, entire.*

30. *Barbus dorsalis*, D. $\frac{3-4}{8}$. A. $3\frac{3}{5}$, L. 1. 24. Dorsal ray moderately strong, $2\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Madras and Ceylon.*
31. *Barbus chola*. D. 3/8. A. $2\frac{2}{5}$, L. 1. 26. Dorsal ray moderately strong, 3 to $3\frac{1}{2}$ rows of scales between lateral line and base of ventral fin. *India and Burma.*
32. *Barbus amphibius*. D. $\frac{2-3}{8}$. A. $2\frac{2}{5}$. L. 1. 23. Dorsal ray feeble, 2 rows of scales between l. 1. and base of ventral fin. *Western coast of India.*
33. *Barbus parrah*. D. 3/8 A. $3\frac{3}{5}$ L. 1. 25. Dorsal ray moderately strong. *Southern India.*
34. *Barbus titius*. D. 3/8. L. 1. 25, complete. Two black spots. *Bengal and N. W. Provinces.*
35. *Barbus thermalis*. D. 3/8. A. $3\frac{3}{5}$. L. 1. 25. incomplete. Dorsal ray moderately strong, $3\frac{1}{2}$ rows of scales between l. 1. and base of ventral fin. *Mysore, Ceylon, Cachar.*
36. *Barbus lepidus*. D. 3/8 A. $2\frac{2}{5}$ L. 1. 21. Dorsal ray feeble, the divided rays elongate, 2 rows of scales between l. 1. and base of ventral fin. *Southern India and Ceylon.*

c *No osseous dorsal ray.*

37. *Barbus kolus*, D. $\frac{3-4}{9}$. A. $3\frac{3}{5}$. L. 1. 40—42; 4 rows of scales between l. 1. and base of ventral fin. *Deccan, also Kistna river.*
38. *Barbus curmuca*. D. 3/8. A. $3\frac{3}{5}$. L. 1. 42. L. tr. 18. *Southern India.*
39. *Barbus Denisonii*. D. $\frac{2-3}{8}$. A. $3\frac{3}{5}$. L. 1. 28, 2 rows of scales between it and ventral fin. Body longitudinally banded. *Hill ranges of Travancore.*
40. *Barbus arulius*. D. 3/8. A. $2\frac{2}{5}$. L. 1. 23. L. 1. concave. Body vertically banded. *Western Ghats.*
41. *Barbus Puckelli*. D. 2/7. A. $3\frac{3}{5}$. L. 1. 24. *Mysore.*

C. *Without barbels (Puntius).*a. *With osseous serrated dorsal ray.*

42. *Barbus apogon*. D. 4/8. L. 1. 36, complete; 4 to $4\frac{1}{2}$ rows of scales between l. 1. and ventral fin. Each scale with a dark base. *Burma.*

43. *Barbus ambassis*. D. 3/8. L. 1. 36, incomplete, 6 rows of scales between it and ventral fin. Uniform. *Continent of India.*

44. *Barbus conchoni*. D. 3/8. L. 1. 26, incomplete, $4\frac{1}{2}$ rows of scales between it and ventral fin. A black spot on side over anal fin. *Bengal and Behar.*

45. *Barbus gelius*, D. 3/8. L. 1. 25, incomplete, black band over tail, a black spot across the bases of the first 6 dorsal rays, and another over base of anal. *Orissa and Bengal.*

46. *Barbus ticto*, D. 3/8. L. 1. 23, incomplete. Two black spots, one at commencement of lateral line, another at the side of the tail. *Throughout India, except Malabar coast.*

47. *Barbus punctatus*, D. 3/8. L. 1. 23, complete. Two black spots, one below the commencement of lateral line, the other near its termination. *Malabar coast.*

48. *Barbus phutunio*, D. $\frac{2-3}{8}$. L. 1. 20—23, incomplete. Four vertical black bands on a brown body, and a dark one down the centre of the dorsal fin. *Bengal, Orissa and Ceylon.*

49. *Barbus nigrofasciatus*, D. 3/8. L. 1. 20, complete. Three vertical black bands on body. *Southern Ceylon.*

50. *Barbus guganio*, D. 2/8. L. 1. incomplete. *Bengal and Assam.*

51. *Barbus Stoliczkanus*, D. 2/8. L. 1. 25, complete. Two black marks on lateral line. *Eastern Burma.*

52. *Barbus pyrrhopterus*, D. 2/7. L. 1. 22-24, complete. A dark spot near posterior end of the lateral line.

b. *Osseous dorsal ray, entire.*

53. *Barbus stigma*, D. 3/8. L. 1. 25, complete. A dark mark near the posterior extremity of the lateral line, another across the base of the middle dorsal rays. *Throughout India and Burma.*

54. *Barbus chrysopterus*, D. 3/8. L. 1. 23, complete. Fins black tipped. *N. India.*

55. *Barbus unimaculatus*, D. 3/8. L. 1. 24, incomplete. A black mark at the base of each dorsal ray. *Tenasserim Provinces.*

56. *Barbus filamentosus*, D. 3/8. L. 1. 21, complete. Branched dorsal rays elongated. A black mark near posterior end of lateral line, and each caudal lobe with a black extremity. *Malabar coast and Southern India.*

57. *Barbus terio*, D. 3/8. L. 1. 21, incomplete. A black mark on side above the anal fin, sometimes continued by a band to the caudal, a second indistinct one under posterior end of dorsal. *Orissa and Bengal.*

58.\* *Barbus Duvaucelii*, D. 2/8. L. 1. 27, complete. A black spot near the posterior end of the lateral line. *Bengal.*

59. *Barbus vittatus*, D. 2/8. L. 1. 20—22, incomplete. Four black spots on the side, and a black streak down the dorsal fin. *Malabar and Mysore.*

c. Without osseous dorsal ray.

60. *Barbus Punjaubensis*, D. 3/8. L. 1. 43, incomplete. A silvery band along the side, a black spot at base of caudal, and two first dorsal rays black. *Lahore in the Punjab.*

61. *Barbus cosuatis*, D. 3/8. L. 1. 22, incomplete. Uniform, a dark spot across the middle of the anterior anal rays. *Bengal.*

62.\* *Barbus presbyter*, D. 11. A. 7. L. 1. 26. Uniform. *Bombay.*

63. *Barbus puntio*, D. 3/8. L. 1. 23, incomplete. A black band encircles the free portion of the tail. *Bengal and Burma.*

A. With four barbels, (*Barbodes*).

a. Last undivided dorsal ray, osseous and serrated.

1. BARBUS (*Barbodes*) CHAGUNIO.

Cyprinus chagunio, Ham. Buch., *Fishes of Ganges*, pp. 295, 387.

Rohita chagunio,\* Cuv. and Val., xvi, p. 257.

Barbus chagunio, McClelland, *Ind. Cyp.*, pp. 272, 341; Day, *Proc. Zool. Soc.* 1869, p. 373.

„ *spilopholis*, McClell., l. c., pp. 272, 341, pl. 39, f. 4; \*Cuv. and Val., xvi, p. 171; Günther, *Catal.* vii, p. 96.

„ *Beavani*, Günther, *Catal.* vii, p. 96.

Jerruah, Beng. *Chaguni*, Behar.

B. III. D. 3/8. P. 15. V. 9. A. 3/5. C. 19. L. 1. 44—47. L. tr. 11/11.

Length of head $1/5$, of caudal $1/5$, height of body $2/9$ of the total length.

Eyes. Diameter $1/4$ of length of head, $1\frac{1}{2}$ diameters from end of snout, $1\frac{1}{2}$ diameters apart.

Suborbital region, cheeks and anterior superior margin of the orbit usually covered with numerous pores. Barbels slightly longer than the orbit. Mouth somewhat inferior but directed forwards.

Fins. Dorsal commences midway between the end of the snout and the base of the caudal fin, its last undivided ray is osseous, strong, with coarse teeth: the last few anal rays sometimes elongated, (*B. spilopholis*).

Lateral line,—complete, with from five and a half to six and a half rows of scales between it and the base of the ventral fin.

Colours. Uniform silvery, with a pinkish tinge, the scales towards the back sometimes being darkest at their bases.

McClelland considered *Barbus chagunio* and *B. spilopholis* merely as varieties of the same species, slightly differing in colour and also in the elongation of some of the last anal rays, and having seen specimens of the latter and many of the former, I certainly think him to be correct. I have taken both also at Delhi.

Hab. From Orissa throughout Bengal, Behar and North-West Provinces to the Punjáb, but apparently not extending into Madras or Burma. It attains a foot and a half in length.

Hamilton Buchanan has left amongst his drawings an excellent representation of this fish.

2. \*BARBUS (*Barbodes*) CLAVATUS.

McClelland, Calc. Journ. Nat. hist. 1845, p. 280, pl. 21, f. 2; \*Günther, Catal. vii. p. 97.

B. III. D. 11. A. 8. L. 1. 42.

Height of body more than the length of the head, and contained $4/15$ in the total length without the caudal fin.

Eyes. Midway between snout and opercle.

Snout covered with small thorny tubercles. Barbels well developed, and equal in length.

Fins. Osseous dorsal ray, strong, serrated, and as high as the body, none of the anal rays prolonged.

Scales. Eleven and a half rows between the base of the ventral and the dorsal.

Colours. Uniform silvery.

Hab. Sikkim. Perhaps a variety of the last species.

3. BARBUS (*Barbodes*) IMMACULATUS.

Systomus immaculatus, McClell., Ind. Cyp., pp. 284, 380, pl. 44, f. 5.

„ *chrysosomus*, McClell., l. c. pp. 284, \*Cuv. and Val. xvi, p. 409.

Cyprinus M' Clellandi, Cuv. and Val., xvi, p. 390.

Barbus Duraucelii, Cuv. and Val., xvi p. 167.

„ *immaculatus*, Günther, Catal. vii, p. 113.

B. III. D. $3/8$. P. 15. V. 9. A. $3/5$. C. 19. L. 1. 32-33. L. tr. $6/6$.
Length of head $1/5$, of caudal $1/5$, height of body $3/10$ of the total length.

Eyes. Diameter $1/4$ of length of head, 1 diameter from end of snout.

Profile of back elevated. Barbels short.

Fins. Osseous dorsal ray of moderate strength, finely serrated posteriorly and its stiff portion being two-thirds as long as the head; the origin of the fin is midway between the end of the snout and the base of the caudal.

Scales. Four rows between the lateral line and the base of the ventral.

Colours. Greenish above, becoming white beneath; fins pale, opercles tinged with red.

Hab. Bengal, Assam, Sikkim and the N. W. Provinces. It is very closely allied to the *B. sarana*, H. B. McClelland appeared to consider it a variety, and he was probably correct, but more specimens are required for comparison.

4. BARBUS (*Barbodes*) SARANA.

Kunnamoo, kakoo and kadoon, Russell, Fish. Vizag. ii, pp. 82, 83, pl. 204.

Cyprinus sarana, Ham. Buch., Fish. Ganges, pp. 307, 388.

Barbus sarana and *deliciosus*, McClell., Ind. Cyp. pp. 272, 340, 341, pl. 39. f. 3; \*Cuv. and Val. xvi, p. 172.

„ *kakus*, \*Cuv. and Val., xvi, p. 153.

„ *gardonides*, Cuv. and Val., xvi, p. 156, pl. 456; Bleeker, Verh. Bat. Gen. Ned. Ind., xxv, p. 126; \*Jerdon, M. J. L. and S., 1849, p. 313.

„ *chrysopoma*, Cuv. and Val. xvi, p. 165, pl. 466; Day, Fishes Malabar, p. 208; Günther Catal. vii, p. 113.

„ *subnasutus*, Cuv. and Val., xvi, p. 154; \*Jerdon M. J. L. and S. 1849, p. 313.

Barbus gibbosus, Cuv. and Val., xvi, p. 155 ; \*Jerdon, M. J. L. and S. 1849, p. 313.

„ *rubripinnis*, Cuv. and Val., xvi, p. 194 ; Bleeker, Nat. Tyd. Ned. Ind. ix, p. 193 ; Günther, Catal. vii, p. 116.

„ *orphoides*, Cuv. et Val., xvi, p. 193.

„ *saramanella*, Bleeker, Verh. Bat. Gen. xxiii, Oost—Java, p. 16.

Puntius (Barbodes) rubripinna, Bleeker, Prod. Cyp., p. 338, and Atl. Ich. Cyp. p. 100, t. 33, f. 3.

Systomus chrysopoma, Jerdon, M. J. L. and S. 1849, p. 314.

Barbus sarana, Cuv. and Val., xvi, p. 151 ; Jerdon, M. J. L. and S. 1849, p. 312 ; Günther, Catal. vii, p. 121 ; Day, Proc. Zool. Soc. 1869, p. 374.

Barbus caudimarginatus, Blyth, J. A. S. of B. 1860, p. 157.

Puntius chrysopoma, Bleeker, Cobit. et Cyprin. Ceylon, in Mem. Soc. Harl. 1864, p. 15, t. 3, f. 1.

„ *sarana*, Stein., Sitz. Ak. Wiss. Wien. lvi.

Barbus spilurus, Günther, Catal. vii, p. 114.

Munduttee, Mal. ; *Pungella*, Tamil. ; *Giddi kaoli*, Durhie and Potah, Hind. ; *Gid-pakke*, Can. ; *Kannaku*, Tel. ; *Sarana*, Ooriah and Beng. *Jundoori*, Punj. ; *Nga-khon-mah-gyee* and *Nga-chong*, Burmese.

B. III. D. $\frac{3-4}{8}$. P. 15. V. 9. A. $\frac{3}{5}$. C. 19. L. 1. 29—31. L. tr. $\frac{5\frac{1}{2}}{5\frac{1}{2}}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{7}$ of the total length.

Eyes. Diameter in the immature $\frac{2}{7}$, in the adult $\frac{1}{4}$ of the length of head, from 1 to $1\frac{1}{4}$ diameters from end of snout, 2 diameters apart.

A considerable rise to the base of the dorsal fin : body compressed. Head moderately broad, with the interorbital space convex. Barbels about as long as the eye.

Fins. Origin of dorsal nearly opposite ventrals, and midway between the end of snout and base of caudal ; its last undivided ray osseous and serrated posteriorly, the strength of which varies with age and sex, its osseous portion is two-thirds as long as the head, but subject to slight variation either way.

Scales. There are from three to three and a half rows between the lateral line and the base of the ventral fin.

Colours. These vary considerably ; in some, more especially when not in the breeding season, they are uniform with or without a lateral blotch on the side of the tail generally darkest in the

immature. Occasionally, more especially amongst the young and breeding fish, each scale has a darkish base, which in Burma becomes almost black, as are also the lateral margins of the caudal fin: whilst some have a dark mark over the shoulder behind the opercles.

In one female specimen at Trichinopoly I found about 410,745 eggs.

Hab. This fish has a very extensive range, being found throughout India, Burma and Ceylon. In this extensive district, and subject to domestication, variations to a slight extent are perceptible, but not I think sufficient to form species, any more than are the varieties of the gold carp. But this is a matter of individual opinion, apparently not shared in by Bleeker or Dr. Günther. However I have personally examined at the British Museum the following specimens and the foregoing is the conclusion arrived at: The specimen of *B. rubripinnis*, C. V., received from Bleeker is identical with the variety termed *B. caudimarginatus*, Blyth. The *B. spilurus*, Günther, from Ceylon has the head a little sharper than other specimens and the barbels a trifle longer.\* I possess specimens from Malabar on the Western coast of India, to almost the extreme limits of British Burma, and from the intermediate districts, in all of which places this fish, which grows to upwards of two feet in length, is highly esteemed as food, and much employed for stocking tanks.

5. BARBUS (*Barbodes*) PINNAURATUS.

? *Barbus Polydori*, Cuv. & Val, xvi, p. 170.\* Günther, Catal., vii., p. 122.

Cyclocheilichthys pinnauratus, Day, Proc. Zool. Soc. 1865, p. 300.

Puntius pinnauratus, Day, Fish. Malabar, p. 209. pl. 15, f. 2.

Barbus pinnauratus,\* Günther, Catal, vii, p. 114.

„ *Russellii*, Günther, Catal., vii, p. 121.

B. III. D. 3/8. P. 17. V. 9. A. 2/6. C. 21. L. 1. 27-29. L. tr. 6/5.

Length of head above 1/4, of caudal 1/4, height of body 1/3 of the total length.

Eyes. Diameter 1/4 of length of head, 1 diameter from end of snout: upwards of 1 diameter apart.

\* *Russell* described and figured the *B. sarana*; his other two species are doubtless identical, the first from a tank near Tartoor, the other from the Ankapilly tank.

Body compressed, dorsal profile elevated. Rostral barbels not so long as maxillary which nearly equal one diameter of the orbit.

Fins. Dorsal commences midway between the end of the snout and the base of the caudal, its last undivided ray being osseous, strong, finely serrated posteriorly with its stiff portion as long as the head without the snout.

Lateral line—complete.

Scales. $3\frac{1}{2}$ rows between lateral line and base of ventral fin.

Colour. Silvery with a dark spot on the 24th to 28th scales of the lateral line. Opercles and fins orange except the caudal which is stained darkish at its margin.

Hab. Indus, Kurnool, and Malabar. It appears to be a small species, the largest I have taken was 5 inches in length.

6. BARBUS (*Barbodes*) PLEUROTÆNIA.

Puntius (*Barbodes*) *pleurotænia*, Bleeker, Cobit. et Cypr. Ceylon, in Nat. Verh. Holl. Maatsch. Harl. 1864, p. 13, t. 8, f. 2.

Barbus pleurotænia, Günther, Catal., vii, p. 120.

B. III. D. $3/8$. P. 14. V. 9. A. $3/5$. C. 19. L. 1. 28. L. tr. $5/4\frac{1}{2}$.

Length of head about $1/5$ ($4/21$), of caudal $1/5$, height of body $1/4$, of dorsal fin $2/9$ of the total length.

Eyes. Diameter $2/7$ of length of head, $1\frac{1}{4}$ diameters from end of snout, and slightly more apart.

Body compressed and elevated: upper jaw slightly the longest.

Barbels somewhat longer than the orbit.

Fins. Dorsal commences over the ventral, and midway between the end of the snout and the base of the caudal; its last undivided ray is osseous, very strong, serrated posteriorly, and as long as the head, the upper margin of the fin concave; caudal forked.

Lateral line—complete, $2\frac{1}{2}$ rows of scales between it and the root of the ventral.

Colour. A black band extends from the eye to the termination of the central caudal rays.

Hab. Ceylon.

7. \* BARBUS (*Barbodes*) GONIOSOMA.

Puntius (Barbodes) goniosoma, Bleeker, Prod. Cyp., p. 349, and Atl. Ich. Cyp. p. 105, t. 31, f. 1.

Barbus goniosoma, Günther, Catal. vii, p. 124.

B. III. D. $3/8$. P. 15. V. 8. A. $2/5$. C. 19. L. 1. 24. L. tr. $4\frac{1}{2}/4\frac{1}{3}$.

Length of head nearly $1/5$, of caudal $2/11$, height of body nearly $1/3$, of dorsal fin $1/5$ of the total length.

Eyes. Diameter $2/7$ of length of head, $1\frac{1}{4}$ diameters from end of snout, and the same distance apart.

Body rather elevated to the base of dorsal fin, whilst it is strongly compressed.

Rostral barbels extend to below the middle of the eye; the maxillary ones to opposite the posterior margin of the orbit.

Fins. Dorsal commences slightly posterior to the ventrals, and midway between the anterior margin of the orbit and the base of the caudal; its spine is osseous, strong, as long as the head without the snout, and finely serrated posteriorly in its whole extent; the divided rays are longer than the osseous ones. Caudal forked, the lower lobe the longest.

Lateral line. $2\frac{1}{2}$ to $3\frac{1}{2}$ rows between it and the base of the ventral fin.

Colour. Silvery, fins orange.

Hab. Mergui to Sumatra. I have obtained specimens at the first place up to 6 inches in length.

8. \* BARBUS (*Barbodes*) ROSEIPPINNIS.

Barbus roseipinnis, Cuv. and Val. xvi, p. 169.

B. III. D. $3/8$. A. $2/5$. C. 20. L. 1. 22.

Dorsal profile elevated.

Eyes large: four barbels.

Fins. Dorsal with its last undivided ray osseous, of moderate length and serrated.

Colour. Silvery: ventral, anal and caudal fins reddish, the lower border of the last tinged with black.

Hab. Pondicherry, from whence M. Belanger brought specimens $4\frac{1}{2}$ inches in length. It would be worth while re-examining

the typical specimens, should they still exist. I have been at Pondicherry and collected as many species of fresh water fish as I was able, but could only find one *Barbus* (*Barbodes*), and that was *sarana* of which *roseipinnis* may possibly be a variety.

9. \* *BARBUS* (*Barbodes*) *RODACTYLUS*.

Barbus rodactylus, McClell., Ind. Cyp. pp. 273; \*Cuv. & Val. xvi, p. 173.

Four barbels.

Fins. Dorsal ray serrated, ten rays in the fin.

Colour. "Fins red and orange, except the dorsal and upper lobe of the caudal."

Hab. Lower Assam. Usual size about five inches in length.

b. *Last undivided ray, osseous and entire.*

10. *BARBUS* (*Barbodes*) *DUBIUS*.

Puntius (*Barbodes*) *dubius*, Day, Proc. Zool. Soc. 1867, p. 291.

Barbus dubius, \*Günther, Catal. vii, p. 127.

B. III. D. 4/9. P. 17. V. 9. A. 2/5. L. 1. 42. L. tr. 9/7.

Length of head nearly 1/5, of caudal a little above 1/4, height of body nearly 1/4 of the total length.

Eyes. Diameter 2/7 of length of head, 1½ diameters apart, and from end of snout.

Dorsal profile more convex than that of the abdomen. Barbels rather short, its two pairs being of about the same length and equal to half the diameter of the orbit. Snout somewhat elevated.

Fins.—Dorsal spine osseous, smooth, and strong, it is nearly as long as the head, commencing midway between the end of the snout and the base of the caudal.

Lateral line—complete; five rows of scales between it and the base of the ventral fins.

Colour. Uniform silvery.

Hab. Bowany river at the foot of the Neilgherries.

I have elsewhere expressed a doubt whether this may not eventually prove to be *B. Mysorensis*, Jerdon, there are, however rather smaller scales in this species.

11. BARBUS (*Barbodes*) MYSORENSIS.

Barbus gracilis, Jerdon, M. J. L. and S. 1849, p. 313, (not Schleg.)

„ *Mysorensis*, Jerdon, l. c.

Puntius gracilis, Day, Proc. Zool. Soc. 1867, p. 290 ; 1870, p. 290.

Barbus conirostris, Günther, Catal. vii, p. 127.

Coatee candee, Tamil.

B. III. D. 4/9. P. 17. V. 9. A. $\frac{2-3}{5}$. C. 19. L. 1. 40. L. tr. 7/7.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{2}{7}$ of the total length.

Eyes. Diameter $\frac{2}{7}$ of length of head, $1\frac{1}{4}$ diameters apart, and from end of snout.

Dorsal profile more convex than abdominal.

Snout conically pointed. Cleft of mouth extending scarcely half the distance to below the anterior margin of the orbit ; upper jaw slightly the longest. Rostral barbels extend to below the anterior third of the orbit, the maxillary ones to below its posterior margin.

Teeth, pharyngeal—crooked, pointed, 4, 3, 2/2, 3, 4.

Fins. Dorsal commences over the ventrals, its osseous ray is strong, smooth and somewhat compressed, its stiff portion being slightly longer than the head. Caudal deeply forked.

Lateral line—complete, with a slight downward bend in the first portion of its course ; 3 rows of scales between it and the base of the ventral fin.

Colours. Cheeks golden, body with a greenish tinge superiorly, becoming white below the lateral line, the base of each scale somewhat the darkest.

Hab. Rivers around the base of the Neilgherries, and Wynaad range of hills. It attains a large size, some were introduced by me into the Ootacamund lake.

12. BARBUS (*Barbodes*) CARNATICUS.

Barbus Carnaticus, Jerdon, M. J. L. S. 1849, p. 311 ; Günther, Catal. vii, p. 128.

Puntius (Barbodes) Carnaticus, Day, Proc. Zool. Soc. 1867, p. 292.

Poaree candee, *Saal candee*, *Shellee*, Tamil., *Giddi-kaoli*, Hind.

Gid-pakke, Can.

B. III. D. 4/8, P. 15, V. 9, A. $\frac{2-3}{5}$, C. 19, L. 1. 30—32, L. tr. 5/5.

Length of head $2/11$, of caudal $1/6$, height of body rather more than $1/4$, of dorsal $1/7$ of the total length.

Eyes. Diameter $1/4$ of length of head ; $1\frac{1}{2}$ diameters from end of snout.

Body oblong and compressed. Dorsal profile more convex than the abdominal. Cleft of mouth extending to nearly below the anterior margin of the orbit. In adults the summit of the head is rugose, with a slight depression across the snout. Rostral barbels thin, they reach to the anterior margin of the orbit, the maxillary are shorter and thicker.

Teeth, pharyngeal—pointed and uncinatè, 5, 3, $2/2$, 3, 5.

Fins. Dorsal nearly square, commencing midway between the snout and the base of the caudal fin ; osseous ray broad, strong, its stiff portion being as long as the head without the snout. Anal when laid flat reaches as far as the base of the caudal which last is deeply forked.

Lateral line—complete, first slightly descending ; $2\frac{1}{2}$ rows of scales between it and the base of the ventral fins.

Colours. Brownish, dashed with green along the back, silvery white abdomen. Fins greyish. Eyes golden.

Hab. Rivers along the bases of the Neilgherries and Wynaad range of Hills. It grows to 25 lb. in weight. Some have been introduced by me into the lake at Ootacamund.

13. BARBUS (*Barbodes*) JERDONI.

Day, Proc. Zool. Soc. 1870, p. 372.

B. III. D. $3/9$, P. 15, V. 9, A. $3/5$, C. 19, L. 1. 28, L. tr. $6/4$.

Length of head $1/6$, of caudal $1/4$, height of body $1/4$ of the total length.

Eyes. Diameter $1/3$ of length of head ; 1 diameter from end of snout.

A considerable rise to the commencement of the dorsal fin ; body compressed.

The maxilla extends to below the anterior margin of the orbit. Barbels thin, the maxillary being as long as the orbit, the rostral slightly shorter.

Fins. Last undivided dorsal ray osseous but weak and not

enlarged, its stiff portion being as long as the head without the snout : the fin commences midway between the snout and the base of the caudal which last is forked.

Lateral line—complete, 4 rows of scales between it and the base of the ventrals.

Colours. Silvery, fins tipped with black.

Hab. Rivers in Canara below the Ghâts. H. E. Thomas, Esq., gave me one specimen.

14. BARBUS (*Barbodes*) HEXASTICHUS.

Barbus hexastichus, McClelland, Ind. Cyp. pp. 269, 333, pl. 39, f. 2; Günther, Catal vii, p. 129.

Barbus hexagonolepis, McClell., l. c. pp. 270, 336, pl. 41, f. 3.

Lobura and *Bokar*, Assam.

B. III. D. $\frac{3-4}{9}$, P 17, V. 9, A. $\frac{2}{5-6}$, C. 19, L. l. 25-27, L. tr. $\frac{4-4\frac{1}{2}}{4-5}$.

Length of head $\frac{1}{6}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{9}$ of the total length.

Eyes. Diameter $\frac{1}{5}$ of length of head; $1\frac{1}{2}$ diameters from end of snout; 2 diameters apart.

Interorbital space slightly convex; opercle higher than wide. Lips moderately thick, the lower one without a lobe, but having a shallow and continuous transverse fold. Mouth rather inferior, directed anteriorly; the upper jaw slightly the longest. Some pores on the cheeks.

Fins. Dorsal fin with its osseous ray, strong, smooth, and as long as the head without the snout; it commences somewhat nearer the snout than the base of the caudal, the latter being deeply forked, with the lower lobe the longest.

Lateral line—complete, $2\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours—uniform silvery.

Habitat. Rivers around Himalayas, Cashmere, Sikkim and Assam. Growing to $2\frac{1}{2}$ feet in length.

15. BARBUS (*Barbodes*) MOSAL.

Cyprinus mosal, and *putitora*? Ham. Buch., Fish. Gang. pp. 303, 306, 388; Gray and Hard. Ind. Zool.; McClelland, Ind. Cyp. pp. 271, 303, 337, 388, pl. xli, f. 3; Cuv. and Val. xvi, p. 197; Jerdon M. J. L. and S. 1849, p. 311.

Barbus megalepis, McClelland., Ind. Cyp. pp. 271, 337.

„ *musculah* ? Sykes, Trans. Zool. Soc. ii, pp. 356.

„ *Malabaricus et tristis*, Jerdon, M. J. L. and S. 1849, p. 312.

„ *macrocephalus*, McClell., Ind. Cyp. pp. 270, 335, pl. 55, f. 2 ; \*Cuv. and Val. xvi, p. 201 ; \*Günther, Cat. vii, p. 131 ; Day, Proc. Z. S. 1869, p. 556.

Barbus mosal, \*Cuv. and Val. xvi, p. 200 ; Day, Proc. Z. S. May, 1870, p. 372.

Burapatra, Assam.

B. III. D. $\frac{3}{9}$, P. 19, V. 9, A. $\frac{2-3}{5}$, C. 19, L. 1. 25-27, L. tr. $\frac{3\frac{1}{2}-4}{4}$.

Length of head $2/9$, of caudal $1/5$, height of body $1/5$ of the total length.

Eyes. Diameter $1/4$ of length of head ; nearly one diameter from end of snout, and apart.

Snout rounded and not compressed ; jaws of equal length ; mouth not deeply cleft ; no lobed cartilaginous lips. Four barbels.

Fins. As in *B. tor*.

Lateral line—complete, 2 to $2\frac{1}{2}$ rows of scales between it and the base of the ventral fins.

Colours. Uniform silvery.

Habitat. Mountain streams or those which are rocky and not far distant from high lands. It occurs in Canara and generally throughout India in the localities specified. It attains 3 feet and more in length.

16. BARBUS (*Barbodes*) TOR, pl. xxi, 5-6.

Cyprinus tor, Ham. Buch., Fishes of Ganges, pp. 305, 388.

Barbus (Labeobarbus) Hamiltonii, Gray and Hardwicke, Ind. Zool. pl. ; Jerdon M. J. L. and S. 1849, p. 311.

Barbus progeneius, McClell., Ind. Cyp. pp. 270, 334, pl. 56, f. 3 ; \*Cuv. and Val. xvi, p. 208.

• ? *Labeobarbus macrolepis*, Heckel, Fish. Kashmir, p. 60, t. 10, f. 2, \*Cuv. and Val. xvi, p. 209,

Labeobarbus tor, Bleeker, Cobit et Cyp. Ceylon in Nat. Verh. Holl. Maat. Haar. 1864, p. 10, f. 2. Day, Proc. Zool. Soc. 1867, p. 290 ; 1870, p. 372.

Barbus khudree, Sykes, T. Z. S. ii, p. 57.

Barbus tor, \*Cuv. and Val. xvi, p. 199.

Barbus (Barbodes) tor, Day, l. c. 1869, pp. 270, 334.

„ *mosal*, Günther, Catal. vii, p. 130.

„ *macrolepis*, \*Günther, Catal. vii, p. 131.

„ *longispinis*, Günther, Catal. vii, p. 132.

Poo-meen-candee, Tamil. ; *Naharm* Hind. ; *Kukkiah*, Punjáb.

B. III. D. 3/9, P. 18, V. 9, A. 2/5, C. 19, L. 1. 23-27, L. tr. 4/4.
Vert. 20/21.

Length of head 2/9, of caudal 1/5, height of body 1/5 of the total length.

Eyes. Diameter 1/4 of length of head ; about 1 diameter from end of snout, and rather less apart.

Snout pointed and compressed, the lower jaw being the shortest ; mouth somewhat deeply cleft, whilst thick cartilaginous lips generally exist in both jaws forming a lobe above and below,\* the summit of the head being nearly flat. These lobes may be larger or smaller, but only designating varieties not distinct species ; and the same I consider with regard to the relative length of the dorsal spine (*B. longispinis*), and even in this last, besides the slight development of the lower lobe, the snout is rather pointed. Maxillary barbels longer than the rostral ones.

Teeth, pharyngeal—crooked, with sharp extremities 5, 3, 2/2, 3, 5.

Fins. Dorsal spine strong, entire, and from half to as long as the head, varying in different localities, and amongst specimens in the same locality ; upper margin of fin slightly concave. Caudal deeply forked.

Lateral line—complete, 2 rows of scales between it and the base of the ventral fins.

Colours. Uniform silvery.

Hab. Mountain streams, or those which are rocky and not far removed from high land, throughout India. It has been taken from the Himalayas to the Neilgherries. In the Punjáb and N. W. Provinces it descends rivers and canals during the cold season, re-ascending when practicable towards their sources as the hot months set in. They appear to breed also in the vicinity of or on the hills, attaining 3 feet or more in length. The largest specimen I heard of weighed 92 lb., at which size the fish becomes coarse, oily and very inferior as food. Up to 20 lb. weight or

\* Amongst 20 specimens all of about 10 inches in length and taken the same day in the *Chukkee*, a hill affluent of the Sutlej, I found in two the snout elongated overhanging the upper jaw, in several the middle of the upper lip elongated, but to varying lengths, and in a smaller number no elongation of the upper lip. The median lobe of the lower lip was very variously produced, but apparent in all.

thereabouts they are excellent eating. A noted sportsman in the N. W. Provinces writing to me says, his largest fish taken with a rod and line was captured "in the river Poonch 24 miles from Jhelum, it measured from snout to bifurcation of tail 3 feet 11 inches and weighed 62 lb." \*\* "the cube of a fish's length gives his weight in pounds; fish may vary a pound or two according to condition, but the test is wonderfully correct."

17. BARBUS (*Barbodes*) SOPHORE.

Cyprinus sophore, Ham. Buch, Fish. Ganges, pp. 310, 389, pl. 19, f. 86.

? *Barbus micropogon*, Cuv. and Val., xvi, p. 188.

„ *sophore*, Day, Proc. Zool. Soc. 1869, p. 376, (not Günther).

B. III. D. 3/9, P. 15, V. 9, A. 2/5, L. l. 25, L. tr. $3\frac{1}{2}/4\frac{1}{2}$.

Length of head $\frac{1}{4}$ of length of body, height of body slightly more.

Eyes. Rather more than $\frac{1}{3}$ of length of head, 1 diameter from end of snout and apart.

Cleft of mouth extending to below the orbit. The rostral barbels reach the anterior margin of the eye, the maxillary ones to below its centre.

Fins. Dorsal ray weak, osseous, entire, and as long as the head without the snout: the fin arises slightly before the ventral, and midway between the end of the snout and the root of the caudal.

Lateral line— $2\frac{1}{2}$ rows between it and the base of the ventral.

There is an old bleached specimen in the Calcutta Museum\* $3\frac{1}{2}$ inches long to the base of the caudal fin, which last is injured from pressure. Specimens in bottles should rest on their heads not on their more fragile tails. *Systomus sophore*, McClelland, is the same as *Barbus stigma*, C. V.

18. BARBUS (*Barbodes*) INNOMINATUS.

Leuciscus binotatus, Blyth, J. A. S. of B., 1858, p. 290, (not K. and v. H.)

Barbus innominatus, Day, Proc. Zool. Soc. 1869, p. 556.

B. III. D. 3/9, P. 15, V. 9, A. 2/5, C. 17, L. l. 24, L. tr. $4\frac{1}{2}/4\frac{1}{2}$.

Length of head $\frac{2}{7}$, of caudal nearly $\frac{2}{7}$, height of body $\frac{2}{7}$ of the total length.

\* Since the above was written the Museum has received about a dozen more small specimens from the Khasi Hills.

Eyes. Diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout and apart.

Barbels four, the rostral nearly reach the orbit, the maxillary are shorter.

Fins. Last undivided dorsal ray weak, osseous, and smooth, the fin commences midway between the snout and the base of the caudal which last is forked in its posterior-two thirds.

Lateral line,—3 rows between it and the base of the ventral.

Colours. A black spot at the base of the caudal fin, none now apparent at the base of the dorsal.

Hab. Ceylon, the specimens in Calcutta are only $1\frac{1}{10}$ inches in length.

19. BARBUS (*Barbodes*) NEILLI.

Barbus Neilli, Day, Proc. Zool., Soc. 1868. p. 581.

B. III. D. $\frac{4}{9}$, P. 15, V. 10, A. $\frac{3}{5}$, L. 1. 24-26, L. tr. $4\frac{1}{4}$.

Length of head $\frac{2}{9}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{3}$ of the total length.

Eyes. Rather high up. Diameter from $\frac{2}{9}$ to $\frac{1}{5}$ of the length of head, $1\frac{1}{2}$ diameters apart and from end of snout.

Head somewhat conical at the snout. Cleft of mouth extending more than half way to beneath the anterior margin of the orbit. Upper jaw slightly the longest. Rostral barbels extend to below the anterior margin of the eye: the maxillary equal $1\frac{1}{2}$ diameters of the orbit in length.

Teeth, pharyngeal, short, curved, 5, 3, $\frac{2}{2}$, 3, 5.

Fins. Dorsal osseous ray weak, entire, with its extremity articulated, the upper margin of the fin concave. Anal laid flat reaches the base of the caudal, the latter fin lunate.

Lateral line—complete, $4\frac{1}{2}$ rows of scales between it and the base of the ventral.

Colours. Silvery above the lateral line, with a dash of yellow below it. Fins with a bluish tinge. Eyes golden.

Hab. Kurnool on the Tamboodra river. This splendid carp, one of the Mahseers of India, is said to attain 50 or 60 lb weight. One of 38 lb was personally examined.

20. BARBUS (*Barbodes*) COMPRESSUS.

Day, Proc. Zool. Soc. 1869, p. 555.

B. III. D. $\frac{3}{9}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 17, L. 1. 22, L. tr. $\frac{4}{5}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{4}$, height of dorsal fin $\frac{1}{8}$ of the total length.

Eyes. Diameter $\frac{2}{9}$ of length of head, $1\frac{1}{2}$ diameters from end of snout and apart.

Head much compressed; the whole of the cheeks covered with pores; the posterior extremity of the maxilla extends to below the anterior margin of the orbit. Rostral barbels reach to beneath the centre of the orbit, the maxillary to the angle of the pre-opercle. Mouth inferior, upper jaw the longest.

Fins. Dorsal arises midway between the snout and the base of the caudal, commencing slightly in advance of the ventrals, its last undivided ray is osseous, not enlarged, and entire. Upper caudal lobe longest.

Lateral line—complete, $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. Silvery, fins stained darker.

Hab. Probably Cashmere.

21. BARBUS (*Barbodes*) MICROPOGON.

Cuv. & Val., xvi, p. 188; Günther, Catal. vii. p. 126.

B. III. D. $\frac{2}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 38, L. tr. $4\frac{1}{5}$.

Length of head (in a stuffed specimen) $\frac{2}{13}$, of caudal $\frac{1}{6}$, height of body $\frac{1}{6}$ of the total length.

The species is elongated; snout rather conical, with the mouth, though somewhat on the inferior surface, directed anteriorly, whilst the upper jaw is the longest.

Barbels apparently short.

Fins. Osseous dorsal ray strong, entire, its stiff portion being three quarters as long as the head, the fin commences opposite the ventrals, and midway between the end of the snout and the base of the caudal, the latter being deeply forked, and its lower lobe the longest. Pectoral extends half way to the base of the ventral.

Lateral line—complete, $2\frac{1}{2}$ rows of scales between it and the root of the ventral fin.

Hab. ? Mysore. I have left this species under the above heading, but am very doubtful respecting its being Cuvier's fish. The specimen in the British Museum appears more like one of McClelland's and probably comes from Assam or Sikkim.

22. BARBUS (*Barbodes*) CHILINOIDES.

McClelland, Ind. Cyp., pp. 271, 340, pl. 57, f. 5; Günther, Catal. vii, p. 127.

Barbus chelynoides, \*Cuv. and Val., xvi, p. 201.

Labeobarbus mosal, Steind., Sitz. Ak. Wiss., Wien, lvi, t. 3.

B. III. D. $\frac{3-4}{7}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 32-35, L. tr. $5\frac{1}{2}/5$.

Length of head $\frac{2}{11}$, of caudal $\frac{2}{11}$, height of body $\frac{2}{11}$, of dorsal fin $\frac{2}{13}$ of the total length.

Eyes. Diameter $\frac{1}{5}$ of length of head, $1\frac{2}{3}$ diameters from end of snout, and two diameters apart.

Mouth somewhat on the inferior surface, directed forwards, with the upper jaw slightly the longest; the snout overhangs the mouth. There are numerous fine glands over the cheeks and opercles; lips moderately thick, the lower without a lobe, but with a continuous transverse fold.

Fins. Osseous dorsal ray very strong, entire, its stiff portion being about three-fifths of the length of the head. Caudal deeply forked.

Lateral line—complete, there are three rows of scales between it and the base of the caudal fin.

Colours. Uniform, the scales in the upper half of the body with dark edges.

Hab. Ganges and Himalayas. Attains 8 inches in length.

23. BARBUS (*Barbodes*) STRACHEYI.

Barbus Malabaricus, Day, Proc. Zool. Soc. 1869, p. 619., (not Jerdon).

B. III. D. $\frac{2}{9}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 17, L. 1. 23, L. tr. $3\frac{1}{2}/5$.

Length of head $\frac{1}{2}$ to $\frac{2}{9}$, of caudal $\frac{1}{6}$, height of body $\frac{2}{7}$ of the total length.

Eyes. Diameter $\frac{1}{5}$ of length of head, $1\frac{1}{2}$ diameters from end of snout, $2\frac{1}{2}$ diameters apart.

Mouth without enlarged lips ; upper jaw somewhat the longest. Summit of head flat. Barbels long, the rostral pair reaching to below the centre of the orbit, and the maxillary pair to beneath its posterior margin.

Fins. Dorsal osseous ray strong, smooth, and as long as the head without the snout, it commences midway between the end of the snout and the base of the caudal fin.

Lateral line,—complete, $2\frac{1}{2}$ rows of scales between it and the base of the ventral fins.

Colours. Uniform silvery.

Hab. Akyab and Moulmein.

I have named this species after General Strachey, C. B., F. R. S., from whom I have received every assistance in prosecuting my enquiries into the fish and fisheries of India.

c. No osseous dorsal ray.

24. BARBUS (*Barbodes*) PULCHELLUS.

Day, Proc. Zool. Soc. 1870, p. 372.

B. III. D. $\frac{4}{9}$, P. 17, V. 10, A. $\frac{3}{6}$, C. 19, L. 1. 30, L. tr. $\frac{6}{5\frac{1}{2}}$.

Length of head $\frac{2}{9}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{2}{9}$ of the total length.

Eyes. Diameter $\frac{2}{7}$ of length of head, $1\frac{1}{4}$ diameters from the end of the snout.

There is a very gradual rise from the snout to the base of the dorsal fin. Interorbital space nearly flat. Mouth of moderate width. The anterior two-thirds of the pre-orbital covered with large mucous pores. Four fine barbels, the maxillary pair being the longest, equalling one-third of the length of the head.

Teeth, pharyngeal,—crooked, pointed, 4, 3, $\frac{2}{2}$, 3, 4.

Fins. Dorsal arises slightly anterior to the ventral and rather nearer to the snout than the base of the caudal fin, its upper border is concave, it is two-thirds the height of the body, having its last undivided ray weak, smooth, and articulated. Anal of moderate size. Caudal deeply forked.

Scales. Four rows between the lateral line and the base of the ventral.

Lateral line—nearly straight.

Colours. All the scales above a line going direct from the eye to the centre of the caudal fin, are of a deep grey with dark bases; below or in the inferior half of the body all are silvery grey.

Hab. Canara, frequenting the inland streams. One specimen $17\frac{1}{2}$ inches long was given me by H. E. Thomas, Esq.

25. \*BARBUS (*Barbodes*) SPINULOSUS.

Barbus spinulosus, McClelland, Cal. Journ. Nat. Hist. 1845, p. 280, pl. 21, f. 3; \*Günther, Catal. vii, p. 128.

B. III. D. $3/9$, P. ? V. 9, A. $2/5$, L. I. 32.

Length of head $1/4$, height of body nearly $1/4$ of the total length.

Eyes. below the middle of the length of the head.

Dorsal profile but slightly arched. Snout short.

Fins. Dorsal without osseous ray, commencing midway between the end of the snout, and the base of the caudal.

Colours. Uniform silvery.

Hab. Sikkim.

26. BARBUS (*Barbodes*) STEVENSONII.

Day, Proc. Zool. Soc. 1870, p. 100.

B. III. D. $3/9$, P. 17, V. 9, A. $3/5$, C. 19, L. I. 27, L. tr. $4\frac{1}{2}/5$.

Length of head $2/9$, of caudal nearly $1/4$, height of body $2/9$ of the total length.

Eyes. Diameter $2/7$ of length of head, 1 diameter from end of snout and apart.

Body elongated and compressed; dorsal profile but little arched. Upper jaw the longest. Maxillary barbels extend to below the posterior extremity of the orbit, whilst the rostral are shorter.

Fins. Dorsal without an osseous ray; it is slightly lower than the body, arising midway between the end of the snout and the base of the caudal, whilst it is slightly in advance of the ventrals.

Lateral line—complete; there are $2\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. Silvery, with a black spot at the base of the caudal fin.

Hab. Hills near Akyab. I named this species after Col. Stevenson, Commissioner at Akyab, who procured me several new species of fish.

27. BARBUS (*Barbodes*) BLYTHII.

Day, Proc. Zool. Soc. 1869, p. 555.

B. III. D. 3/9, P. 15, V. 9, A. 3/5, C. 17, L. 1. 22, L. tr. 4/5.

Length of head 1/4, of caudal 1/4, height of body 2/7 of the total length.

Eyes. Diameter 2/5 of length of head, 3/4 of a diameter from the end of snout and apart.

Pre-orbital covered with pores; opercle two-thirds as high as long. Barbels well developed, the rostral reaching the eye, and the maxillary to below the centre of the orbit.

Fins. Dorsal arises midway between the snout and the base of the caudal, its last undivided ray articulated; it commences slightly in advance of the ventrals. Caudal deeply forked.

Lateral line—complete.

Scales. Two and a half rows between the lateral line and the base of the ventral fin.

Colours. Uniform silvery in spirit.

Hab. Tenasserim provinces. Specimen two inches long.

28. BARBUS (*Barbodes*) MELANAMPYX.

Cirrhinus fasciatus, Jerdon, M. J. L. and S. 1849, p. 305, (not Bleeker.)

Labeo melanampyx, Day, Proc. Zool. Soc. 1865, p. 317.

Puntius melanampyx, Day, Fishes of Malabar, p. 210, pl. 16, f. 1.

Barbus Grayi, Day, Proc. Zool. Soc. 1867, p. 293.

Barbus arulius, Günther, Catal. vii, p. 133. (not Jerdon).

B. III. D. 3/8, P. 15, V. 8, A. 2/5, C. 15, L. 1. 20, L. tr. $3\frac{1}{2}/3\frac{1}{2}$.

Length of head 2/9, of caudal 1/4, height of body 1/3 of the total length.

Eyes. Diameter 1/3 of length of head, from 3/4 to 1 diameter from end of snout; 1 diameter apart.

Dorsal profile much more convex than that of the abdomen.

Cleft of mouth extends to below the anterior edge of the orbit. Rostral barbels short, the maxillary equal in length to one diameter of the orbit.

Teeth, pharyngeal,—in three rows, curved sharp, 5, 3, 2/2, 3, 5.

Fins. Dorsal scarcely higher than long, no osseous ray; it com-

mences midway between the end of the snout and the base of the caudal fin, which latter is deeply forked.

Lateral line—complete and straight; two rows of scales between it and the base of the ventral.

Colours. Of a deep dull red with three black cross bands, the first from below the whole of the base of the dorsal to just beneath the lateral line, the second commences four scales beyond the posterior extremity of the base of the dorsal and descends to one scale below the lateral line, whilst the last is just before the base of the caudal and often wanting. Fins pinkish edged with black.

Hab. The Wynaad, Neilgherry and Travancore ranges of Hills and streams along their bases. It rarely attains three inches in length.

B. *With two barbels (Capoëta).*

a. *With osseous, serrated dorsal ray.*

29. BARBUS (*Capoëta*) HAMPAL.

Capoëta macrolepidota, Cuv. and Val., xvi, p. 280, pl. 477; Cantor, Mal. Fishes, p. 267; Bleeker, Verh. Bat. Gen. xxiii, Oost-Java, p. 21.

Hampala macrolepidota, (Kuhl and Van Hass.), Bleek., Prod. Cyp. ii, p. 308, and Atl. Ich. Cyp. p. 112, t. 38, f. 2.

Barbus hampal, Günther, Catal. vii, p. 139.

B. III. D. 4/8, P. 17, V. 9, A. 2/6, C. 19, L. 1. 26, L. tr. 5/5.

Length of head 2/9, of caudal nearly 2/9, height of body 1/4, of dorsal fin 2/11 of the total length.

Eyes. Diameter 1/5 of length of head, 1½ diameters apart, 1 diameter from end of snout.

Snout pointed, upper jaw slightly the longest; head compressed with its upper surface nearly flat. The posterior extremity of the maxilla extends to below the anterior edge of the orbit. No pores on the snout. The maxillary barbels as long as the orbit.

Fins. Dorsal commences slightly nearer the snout, than the base of the caudal, and a little in advance of the ventrals, its last undivided ray is weak, (scarcely osseous,) and finely serrated in nearly its whole extent. Caudal deeply forked.

Lateral line—with 3½ rows of scales between it and the base of the ventral fin.

Colours. Silvery, fins orange, anterior edge of the dorsal and margins of the caudal black. A badly developed darkish band from the dorsal to the ventral fin.

Hab. Tavoy to the Malayan Peninsula; a fine specimen, 9 inches long, was obtained by me from the first locality.

b. Osseous dorsal ray entire.

30. BARBUS (*Capoëta*) DORSALIS.

Systomus dorsalis, Jerdon, M. J. L. and S. 1849, p. 314.

Barbus dorsalis, Günther, Catal. vii, p. 142.

„ *tetraspilus*, Günther, Catal. vii, p. 142.

„ *Layardi*, Günther, Catal. vii, p. 144.

Lambi kaoli, Hin., *Saal candee*, Tam.; *Mar-pakke*, Can.

B. III. D. $\frac{3-4}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 24, L. tr. $4\frac{1}{2}/4$.

Length of head $\frac{2}{9}$, of caudal $\frac{2}{9}$, height of body $\frac{2}{13}$ of the total length.

Eyes. Diameter about $\frac{1}{4}$ of length of head, from $1\frac{1}{2}$ to $1\frac{1}{2}$ diameters from end of snout, $1\frac{1}{2}$ diameters apart.

Body compressed, a considerable rise to the base of the dorsal fin, and a concavity slightly behind the occiput. The head is rather sharp anteriorly, the snout being somewhat pointed, and the upper jaw the longest. The posterior extremity of the maxilla only extends two-thirds of the distance to below the orbit. Barbels do not reach to beneath the eye.

Teeth, pharyngeal, 5, 3, $\frac{2}{2}$, 3, 5.

Fins. Dorsal commences over the ventral, and nearly midway between the end of the snout and base of the caudal, its last undivided ray is osseous, smooth, moderately strong, and its stiff portion as long as the head without the snout. Caudal forked.

Lateral line—complete.

Scales. About 8 rows between occiput and base of dorsal fin; $2\frac{1}{2}$ rows between lateral line and base of ventrals.

Colours. Uniform silvery frequently dark grey. A black spot at the posterior portion of the base of the dorsal, which more or less disappears after maceration.

Hab. Kurnool, Mysore, Madras and Ceylon, but apparently not extending into Bengal. It does not attain a large size.

The body of *B. tatraspilus* differs from that of *B. dorsalis* in being less deep.

31. BARBUS (*Capoëta*) CHOLA.

Cyprinus chola, Ham. Buch., Fish. Gang. pp. 312, 389; \*Cuv. and Val. xvi, p. 410.

Systomus chola, McClelland, Ind. Cyp. pp. 286, 384, pl. 58, f. 3; Jerdon, M. J. L. and S. 1849, p. 316.

Systomus immaculatus, Blyth, J. A. S. of B. 1860, p. 157.

Puntius (*Capoëta*) *Javanica*, Bleek., Nat. Tyd. Ned. Ind. ix, p. 412.

„ „ *leiacanthus*, Bleek., Prod. Cyp., and Atl. Ich. Cyp. p. 109, t. 36, f. 1.

Systomus sophore? Bleeker, Verh. Bat. Gen. Ned. Ind. 1853, xv, Beng. p. 127.

? „ *Hamiltonii*, Jerdon, M. J. L. and S. 1849, p. 316.

Puntius perlee, Day, Malabar fish, p. 211.

? „ *Hamiltonii*, Day, l. c. p. 213.

Barbus liacanthus, Günther, Catal. vii, p. 141.

„ *chola*, \*Günther, Catal. vii, p. 143; Day, Proc. Zool. Soc. 1869, p. 374.

„ *sophoroides*, Günther, Catal. vii, p. 144.

Koroön, Tam.; *Kerrundi*, Beng.; *Nga-khon-ma*, and *Nga-lowah*, Burmese. *Pittha-kerrundi*, “bitter carp” Ooriah; *Chaddu paddaka*, Tel.; *Katcha karawa*, Hind.

B. III. D. 3/8, P. 15, V. 9, A. 2/5, C. 19, L. l. 26, L. tr. $5\frac{1}{2}/5$.

Length of head 2/9, of caudal 2/9, height of body 1/3 of the total length.

Eyes. Diameter above 1/4 of length of head, 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart.

Maxillary barbels not so long as one diameter of the orbit. Jaws equal in front.

Fins. Dorsal commences slightly before the ventrals, and midway between the end of the snout and the base of the caudal, its last undivided ray is osseous, smooth, with the stiff portion moderately strong, and nearly as long as the head without the snout.

Lateral line—complete, from 3 to $3\frac{1}{2}$ rows of scales between it and the base of the ventrals.

Colours. A dark blotch on the side of the tail, near the posterior end of the lateral line; generally a dark mark at the base of the

four first branched dorsal rays, and a row of black spots along its centre.

Hab. From Malabar throughout India and Burma. It attains to about 5 inches in length. Is bitter as food, but is used in places during the breeding season for obtaining oil from.

32. BARBUS (*Capoëta*) AMPHIBIUS.

Barbus (Capoëta) amphibia, Cuv. and Val. xvi, p. 282, pl. 478.

Systomus amphibioides, Jerdon, M. J. L. and S. 1849, p. 315.

„ *Carnaticus*, Jerdon l. c. p. 315.

Barbus amphibioides, Günther, Catal. vii, p. 144; Day, Proc. Zool. Soc. 1870, p. 373.

B. III. D. $\frac{2-3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 23, L. tr. $4\frac{1}{4}$.

Length of head $\frac{3}{14}$, of caudal $\frac{3}{14}$, height of body $\frac{3}{11}$ of the total length.

Eyes. Diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout.

Mouth narrow, snout somewhat pointed, the upper jaw slightly the longest. Barbels small.

Fins. Dorsal fin $\frac{2}{3}$ as high as body, with its osseous ray feeble, smooth, and half as long as the head, it arises somewhat in advance of the ventrals, and midway between the end of snout, and base of the caudal.

Lateral line—complete, there are two rows of scales between it and the base of the ventral fin.

Colours. Silvery, with a black spot on either side of the tail anterior to the caudal fin, this becomes indistinct after specimens have been long macerated, but is very apparent in fresh ones from the Western coast: it is not well marked and often absent in those taken in Bombay.

Hab. Bombay and the Western coast of India attaining about 6 inches in length.

33. *BARBUS* (*Capoëta*) *PARRAH*, pl. xxi, fig. 4.

Puntius parrah, Day, Proc. Zool. Soc. 1865, p. 301, and Malabar Fishes, p. 211, pl. 7, f. 3; Günther, Catal. vii, p. 142, (*passim*).

Parrah perlee, Mal.; *Katcha-karawa*, Hind.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 25, L. tr. $\frac{5}{4}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{4}$ of the total length.

Eyes. Diameter nearly $\frac{1}{3}$ of length of head, 1 diameter from end of snout, $1\frac{1}{4}$ diameters apart.

Dorsal profile slightly more convex than that of the abdomen. Height of body $\frac{4}{11}$ of its length, excluding the caudal fin. Barbels equal to two-thirds the length of the orbit.

Fins. Dorsal commences midway between the end of the snout and the base of the caudal fin, its last undivided ray is osseous, weak in the young but strengthening with age, and as long as the head without the snout.

Scales. At the fourth scale on the row above the lateral line two rows commence.

Lateral line—complete.

Colours. Back greenish, divided from a silvery abdomen by a dark bluish line. Cheeks golden red. Pectoral, ventral and anal tinged with yellow; dorsal and caudal dusky. A diffused black spot on the lateral line extending from the twentieth to the twenty-second scale. Eyes golden.

Hab. Malabar, Mysore and Madras, growing to 6 inches in length.

Regarding some specimens of *B. parrah* and *B. perlee* presented by me to the British Museum, Dr. Günther observes in his Catalogue "the fish given us as *P. perlee* agrees much more with the description and figure of *P. parrah*, than with that of the species to which the specimen is said to belong." Having re-examined the two fish, both $3\frac{1}{2}$ inches long, I find they have been transposed, an accident which might easily occur, but which could have been as easily rectified by any Ichthyologist, had he felt inclined to do so, when examining the specimens. As only one bottle (*c*) appears to have

contained the specimens when Dr. Günther drew up his Catalogue, judging by both fish being under one and the same heading (*c*) it seems questionable whether the error of misplacement was mine. However, as Dr. Günther was disinclined to correct an evident transposition (by whomsoever made), it accounts for his statement that my figure of *P. parrah* is "not good," because he compared it with a specimen of another species, *P. perlee*, which it was not intended to represent.

The reason why the specimen of $3\frac{1}{2}$ inches long, which I gave to the British Museum, has "its osseous dorsal ray very feeble and much less strong than that in *P. parrah*," as observed by Dr. Günther, is evidently owing to its being an "immature example;" therefore his suggestion that "it is possible the specimen belongs to a distinct species not recognised by Mr. Day" is unnecessary.

34. BARBUS (*Capoëta*) TITIUS.

Cyprinus titius, Ham. Buch., Fish. Ganges, pp. 315, 389; \*Cuv. and Val. xvi, p. 399.

Systomus tetrapagrus, McClell., Ind. Cyp. pp. 285, 381, pl. 44, f. 3.

Barbus titius, \*Günther, Catal. vii, p. 154.

Tit pungti, Bengali: *Borajalee*, Assamese.

B. III. D. $\frac{2}{8}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. I. 25.

Length of head $\frac{1}{4}$, of caudal $\frac{2}{9}$, height of body $\frac{1}{3}$ of the total length.

Eyes. Diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout.

Body equally convex on its dorsal and abdominal profiles.

The barbels not so long as one diameter of the orbit.

Fins. Dorsal commences opposite the ventral, and midway between the snout and the base of the caudal; osseous dorsal ray weak, entire.

Lateral line—complete, $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. A round black spot on the lateral line behind the gill openings, and a second midway between the end of anal and base of the caudal fins. Dorsal and anal tipped with black, sometimes the upper half of the former stained darkish.

Hab. Bengal, Assam, N. W. Provinces and Punjáb, attaining nearly 5 inches in length. Is very common at Hurdwar and Roorkee.

35. BARBUS (*Capoëta*) THERMALIS.

Leuciscus thermalis, Cuv. and Val. xvii, p. 94, pl. 490.

Barbus thermalis, Günther, Catal. vii, p. 143.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 25, L. tr. $5\frac{1}{2}/5\frac{1}{2}$.

Length of head nearly $\frac{1}{4}$ ($\frac{4}{17}$), of caudal nearly $\frac{1}{4}$ ($\frac{4}{17}$), height of body about $\frac{1}{5}$ ($\frac{4}{21}$) of the total length.

Eyes. Diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout.

Body very compressed. Jaws of about equal length: interorbital space convex. Barbels shorter than the eye.

Fins. Dorsal commences midway between the end of snout and base of caudal fin, it is only two-thirds as high as the body, its osseous ray moderately strong, rather longer than the head without the snout.

Lateral line—incomplete, extending for the first eight scales: $3\frac{1}{2}$ rows of the scales between it and the base of the ventral fin.

Colours. Silvery, a round black finger mark on either side of the free portion of the tail, anterior to the base of the caudal fin.

Hab. Mysore, Ceylon, Cachar: attaining 3 inches or more in length.

36. BARBUS (*Capoëta*) LEPIDUS.

Puntius (Capoëta) lepidus, Day, Proc. Zool. Soc. 1868, p. 196.

Barbus filamentosus, Günther, Catal. vii, p. 145, (not Cuv. and Val.)

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 21, L. tr. $\frac{5}{3}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{4}$, height of body $\frac{2}{7}$, of dorsal fin $\frac{1}{5}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, nearly $\frac{2}{3}$ of a diameter from end of snout, 1 diameter apart.

Body strongly compressed. Lower jaw the shortest. Maxillary barbels thin and extending to below the centre of the orbit.

Fins. Last undivided dorsal ray osseous, smooth, feeble; the branched rays are elongated in the adult. Caudal deeply lobed.

Lateral line—complete, slightly concave to opposite the end of the dorsal fin, whence it is straight. $2\frac{1}{2}$ rows of scales between it and the base of the ventral.

Colours. Silvery white, with a deep black oval mark on the lateral line from about the 14th to the 18th scale. Caudal red tipped with black.

Hab. From Canara down the Western coast and along the base of the Neilgherries, also in Ceylon. It grows to 6 inches in length.

Dr. Günther described specimens of *B. lepidus* from Ceylon as *Barbus filamentosus*, which though very similar I hold to be distinct species. He remarks that the barbels of *B. filamentosus* have been overlooked by previous observers, but the reason is that the latter species is destitute of them.

c. No osseous dorsal ray.

37. *BARBUS (Capoëta) KOLUS.*

Barbus kolus, Sykes, Trans. Zool. Soc. ii, p. 357, pl. 62, f. 1; Günther, Catal. vii, p. 136.

Hypselobarbus, (*Gonoproktopterus*) *kolus*, \*Bleeker, Prod. Cyp. p. 275, (name only).

Barbus Guentheri, Day, Proc. Zool. Soc. 1868, p. 582.

Nilusu, Telugu.

B. III. D. $\frac{3-4}{9}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. l. 40—42. L. tr. $\frac{10}{8}$.

Length of head slightly above $\frac{1}{5}$, of caudal $\frac{2}{7}$, of height of body $\frac{1}{4}$, of dorsal fin $\frac{1}{4}$ of the total length.

Eyes. Upper margin near the profile, diameter $\frac{1}{3}$ of length of head, 1 diameter from end of snout and apart.

Body compressed, a considerable rise in the profile from the occiput to the dorsal fin. Upper jaw slightly the longest, the posterior extremity of the maxilla extends to below the anterior margin of the orbit. The pair of maxillary barbels extends rather beyond the middle of the eye.

Teeth, pharyngeal,—pointed, uncinatè, 5, 3, $2\frac{1}{2}$, 3, 5.

Fins. No osseous dorsal ray, the fin commences slightly in advance of the ventrals, and midway between the end of the snout and the base of the caudal fin, which last is deeply lobed.

Lateral line—complete, 4 rows of scales between it and the base of the ventral fin.

Colours. Silvery, with a tinge of yellow.

Hab. Deccan, and throughout the Kistna and Tamboodra rivers. It attains upwards of a foot in length.

38. \**BARBUS (Capoëta) CURMUCA.*

Cyprinus curmuca, Buchanan's Journey Mysore, III. p. 334, pl. xxx; Fishes of Ganges, pp. 294, 387; \*McClelland, Ind. Cyp. pp. 276, 353.

Gobio curmuca et *Canarensis*, Jerdon, M. J. L. and S. 1849, p. 306.

„ *curmuca*, \*Cuv. and Val. xvi, p. 317.

B. III. D. $\frac{3}{8}$, P. 16, V. 9, A. $\frac{3}{5}$, C. 18.

Dr. Jerdon obtained in the Arriacode river near Paulghaut a fish apparently the same as Buchanans, and which he considered to be closely allied to, if not identical with the *Barbus kolus*, Sykes. Having seen his sketches, I must coincide as to suspecting the two to be identical, but unfortunately his specimens have been lost, whilst the *B. kolus* has not been recorded south of the Kistna, so the question must be still left open. There were 42 rows of scales along the lateral line and 18 obliquely, in Dr. Jerdon's specimens from which the drawings were made. The form of the body and head were the same, with some open glands on the snout and below the eyes.

Fins. No osseous dorsal ray.

Lateral line—complete.

Hab. Fresh waters of Southern India, attaining three feet in length. Dr. Jerdon observes as to locality that it is “from the rivers of Palghaut, and Arriacode in south Malabar where it is very common, and I have as yet seen it in no other locality and certainly it is not a common fish in Mysore, or I must have seen it. Buchanan, I may mention, passed over the very locality whence my specimens were obtained in his journey through Mysore.”

39. *BARBUS (Capoëta) DENISONII.*

Labeo Denisonii, Day, Proc. Zool. Soc. 1865, p. 299.

Puntius Denisonii, Day, Fish. Malabar, p. 212, pl. 16, f. 2.

Barbus Denisonii, Günther, Catal. vii, p. 146.

B. III. D. $\frac{2-3}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. l. 28, L. tr. $4\frac{1}{2}/3\frac{1}{2}$.

Length of head $\frac{1}{6}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{5}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, rather above 1 diameter apart and from end of snout.

Dorsal and abdominal profiles slightly and about equally convex. Mouth small, directed forwards and rather downwards, with upper jaw slightly the longest. Maxillary pair of barbels one-third longer than the orbit.

Teeth, pharyngeal,—pointed and curved at their extremities, 4, 3, $\frac{2}{2}$, 3, 4.

Fins. Dorsal arises rather before the ventrals, and midway between the end of the snout, and above the posterior extremity of the base of the anal fin, none of its rays osseous. Caudal deeply forked.

Lateral line—complete, 2 rows of scales between it and ventral fin.

Colours. Silvery, with a black band passing from the snout to the centre of the base of the caudal fin, above it runs a horizontal scarlet band. Caudal with an oblique black band crossing the posterior third of each lobe.

Hab. Mundikyum in the Hill ranges of Travancore, where the Rev. H. Baker, procured me several specimens. It attains six inches in length. I named the species after the late Sir W. Denison, K. C. B., then Governor of Madras.

40. BARBUS (*Capoëta*) ARULIUS.

Systomus arulius, Jerdon, M. J. L. and S. 1849, p. 319.

Puntius arulius, Day, Proc. Zool. Soc. 1867, p. 294.

Barbus arulius, Day, l. c. 1868, p. 585. and 1870, p. 373, (not Günther).

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 18, L. 1. 23, L. tr. $5\frac{1}{2}$.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{8}$, height of body $\frac{1}{4}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, rather above $\frac{1}{2}$ a diameter from end of snout, and $\frac{3}{4}$ of a diameter apart.

Dorsal and abdominal profiles about equally convex. Cleft of mouth extending to nearly below the anterior edge of the orbit. A pair of moderately sized maxillary barbels.

Teeth, pharyngeal,—5, 3, $\frac{2}{2}$, 3, 5, sharp and curved at their extremities.

Fins. No osseous dorsal ray, the fin commences midway between the snout and the base of the caudal, which last is deeply emarginate.

Lateral line—complete, at first somewhat concave, but in its last three-fourths passing straight to the centre of the base of the caudal.

Colours. Olive green on the back, becoming silvery white dashed with reddish green over the abdomen. A black band, about two scales in width, passes from below the origin of the dorsal fin as low as the lateral line: a second from just below the posterior extremity of the dorsal to the base of the anal: and a third across the free portion the tail before the caudal fin. Dorsal caudal and anal pinkish with a black bar across the summit of the first, whilst the caudal is stained at its edges.

Hab. Wynaad and Neilgherry range of hills and the rivers at their bases, attaining four inches or even more in length.

41. *BARBUS (Capoëta) PUCKELLI.*

Puntius (Capoëta) Puckelli, Day, Proc. Zool. Soc. 1868, p. 197.

B. III. **D.** 2/7, **P.** 15, **V.** 9, **A.** 3/5, **C.** 19, **L.** 1. 24, **L. tr.** 4/3.

Length of head 1/5, of caudal 1/6, height of body 2/9, of dorsal fin 1/6 of the total length.

Eyes. Diameter 1/4 of length of head, 1 diameter from end of snout, and 1½ diameters apart.

Dorsal and abdominal profiles both equally and slightly convex, whilst the thickness of the fish equals its height. Mouth almost anterior, upper jaw slightly the longest. The posterior extremity of the maxilla reaches to half way below the orbit. Maxillary barbels thick, reaching to beneath the anterior edge of the eye. No pores on the head, its summit rather convex.

Teeth, pharyngeal, plough-shaped, 5, 3, 2/2, 3, 5.

Fins. Last undivided dorsal ray cartilaginous, the fin commences before the ventral, and midway between the end of the snout and the base of the caudal, which last is lobed in its posterior half.

Lateral line. First descends for three scales, then proceeds direct to the centre of the base of the caudal.

Colours. Greenish yellow along the back, with a red mark on the opercle, and a scarlet stripe extending along the middle of the side. A deep black mark on the dorsal from the base of the third to that of the sixth branched rays. Very fine dark spots over the scales especially at their bases. An indistinct black mark on the lateral line from the nineteenth to the twenty-first scales.

Hab. Bangalore, where it is said to be common. Major Puckell sent me one specimen, 3 inches in length.

C. *Without barbels, (Puntius).*

a. *Last undivided ray, osseous and serrated.*

42. BARBUS (*Puntius*) APOGON.

Barbus apogon, (Kuhl) Cuv. and Val. xvi, p. 392; Günther, Catal. vii, p. 150.

Systomus apogon, Bleeker, Nat. Tyds. Ned. Ind. iii, p. 428.

„ *apogonoides*, Bleeker, l. c. ix, p. 150.

Cyclocheilichthys (anematischthys) *apogon*, Bleeker, Prod. Cyp. p. 378, and Atl. Ich. Cyp. p. 88, t. 29, f. 2.

„ „ *apogonoides*, Bleeker, l. c. p. 379 and Atl. Ich. p. 89, t. 30, f. 3.

Systomus macularius? Blyth, J. A. S. of B. 1860, p. 159.

Barbus macularius, \*Günther, Catal. vii, p. 150; Day, Proc. Zool. Soc. 1869, p. 557.

Nga-ta-zee and *Nga-lay-toun*, Burmese.

B. III. D. 4/8, P. 17, V. 11, A. 3/5, C. 19. L. l. 36, L. tr. 8/7.

Length of head $1/4$ to $1/5$, of caudal $2/9$, height of body $1/3$, of dorsal fin $1/4$ of the total length.

Eyes. Diameter $2/7$ of length of head, 1 diameter from end of snout, $1\frac{1}{4}$ diameters apart.

Body compressed, a great rise from the occiput to the base of the dorsal fin.

Fins. Dorsal commences over the ventral and midway between the end of the snout and the base of the caudal, its last undivided ray is strong, serrated, and rather shorter than the head. First three anal rays somi-osseous. Caudal deeply lobed.

Lateral line—complete, 4 to $4\frac{1}{2}$ rows of scales between it and the root of the ventral.

Colours. Silvery, each scale with a black spot at its base.

Hab. Tenasserim and throughout Burmah to the East Indian Archipelago. It attains 8 inches in length.

43. BARBUS (*Puntius*) AMBASSIS.

Barbus ambassis, Day, Proc. Zool. Soc. 1868, p. 583.

Bunkuai, Oorlah.

B. III. D. 3/8, P. 11, V. 9, A. 2/5, C. 19, L. 1. 36.

Length of head 2/11, of caudal 1/4, height of body 2/7, of dorsal fin 2/11 of the total length.

Eyes. Diameter nearly 2/5 of length of head, 1/2 a diameter from end of snout, 1 diameter apart. Upper jaw slightly the longest, no barbels.

Teeth, pharyngeal, sharp, crooked, 5, 3, 2/2, 3, 5.

Fins. Dorsal spine osseous, strong, and posteriorly serrated, having about 15 teeth, the fin commences slightly anterior to the ventral and midway between the end of the snout and base of the caudal, which last is deeply lobed.

Scales. Small and deciduous.

Lateral line—incomplete, becoming indistinct in the posterior two-thirds of the body, 6 rows of scales between it and the base of the ventral fin.

Colours. Light with a silvery streak along the side. A small black spot at the base of the anterior dorsal rays, and a finger mark at the side of the tail.

Hab. Madras, Orissa and Bengal. It attains about 3 inches in length.

44. BARBUS (*Puntius*) CONCHONIUS.

*Cyprinus conchoni*us, Ham. Buch., Fish. Gang. pp. 317, 389; Cuv. and Val. xvi, p. 394.

*Systemus conehoni*us, \*McClell. Ind. Cyp. pp. 286, 384, pl. 44, f. 8. (from Ham. Buch. Mss.)‡ \*Jerdon M. J. L. and S. 1849, p. 317.

*Puntius conchoni*us, Stein. Sitz. Ak. Wiss. Wein. lvi,

*Barbus conchoni*us, \*Günther, Catal. vii p. 153.

Kunchon pungti, Bengali.

B. III. D. 3/8, P. 11, V. 9, A. 2/5, C. 19, L. 1. 26, L. tr. 5½/6½.

Length of head 1/5, of caudal 2/9, height of body 1/3 of the total length.

Eyes. Diameter 1/3 of length of head, nearly 1 diameter from end of snout.

Fins. Osseous dorsal ray moderately strong and serrated, as long as head without the snout: the fin commences midway between the anterior extremity of the orbit and the base of the caudal, which latter is forked in its last half.

Lateral line—incomplete, $4\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. A round black spot on the lateral line above the posterior portion of the anal fin.

Hab. Lower Bengal, Behar and N. W. Provinces, attaining 5 inches in length.

45. *BARBUS (Puntius) GELIUS.*

Cyprinus gelius, Ham. Buch., Fish. Gang. pp. 320, 390; \*Cuv. and Val. xvi, p. 397.

„ *canius*, Ham. Buch., l. c.; \*Cuv. and Val. xvii, p. 397.

Systomus gelius, McClell., Ind. Cyp. pp. 286, 386, pl. 44, f. 4, (from Ham. Buch. Mss.)

„ *canius*, McClell., l. c. pp. 287, 387, pl. 44, f. 6, (from H. B.'s Mss.)

„ *gelius*, Bleeker, Verh. Bat. Gen. Ned. Ind. xxv, 1853, Bengal, p. 129.

Barbus gelius, Günther, Catal. vii, p. 154 Day, Proc. Zool. Soc. 1869, p. 374.

Cutturpoh, Ooriah; *Geli pungti*, Beng.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 25, L. tr. 9.

Length of head $\frac{2}{9}$, of caudal $\frac{1}{4}$, height of dorsal $\frac{2}{9}$, of body $\frac{1}{3}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, $\frac{2}{3}$ of a diameter from end of snout, 1 diameter apart.

Dorsal profile rather elevated. Barbels absent.

Fins. Dorsal arises slightly in advance of the ventrals, its osseous ray is strong and rather coarsely serrated: caudal deeply forked.

Lateral line—incomplete, ceasing after 5 or 6 scales.

Colours. Reddish brown, with a black band over the tail a little anterior to the base of the caudal fin, and another less distinct over the base of that fin. The peritoneum being black appears like a dark band. A black spot passes across the base of the anterior half of the dorsal, extending one-third the distance up the rays. A black band over the base of the anal, highest in front. Occiput also black.

Hab. Orissa and Bengal, attaining 2 inches in length.

46. BARBUS (*Puntius*) TICTO.

Cyprinus ticto, Ham. Buch., pp. 314, 389, pl. 8, f. 87; \*Cuv. and Val. xvi, p. 393.

Systomus ticto, McClell., Ind. Cyp. p. 382; Bleeker, Verh. Bat. Gen. Ned. Ind. xxv, 1853, p. 128; \*Jerdon, M. J. L. and S. 1849, p. 318.

Rohtee ticto, Sykes, Trans. Zool. Soc. 1841, p. 365.

Systomus tripunctatus, Jerdon, M. J. L. and S. 1849, p. 316.

? *Systomus rubrotinctus*, Jerdon, l. c. p. 317.

Barbus ticto, Günther, Catal. vii, p. 513.

Kaoli and *Kotree*, Hind.

B. III. D. 3/8, P. 15, V. 9, A. 2/5, C. 19, L. 1. 23, L. tr. 5/6.

Length of head 1/5, of caudal 1/4, height of body 1/4, of dorsal fin 1/3 of the total length.

Eyes. Diameter 1/3 of length of head, 1/2 a diameter from end of snout, 1 diameter apart.

Body strongly compressed. Upper jaw slightly the longest, the posterior extremity of the maxilla reaching to under the anterior margin of the orbit.

Teeth, pharyngeal, crooked, pointed, 5, 3, 2/2, 3, 5.

Fins. Osseous dorsal ray strong and serrated, three quarters as long as the body is high. Caudal deeply forked.

Lateral line—incomplete, ceasing after 6 or 8 scales.

Colours. Silvery, sometimes stained with red, a black spot on the side of the tail before the base of the caudal fin and immediately behind the anal: a smaller one (frequently absent) at the commencement of the lateral line. Fins often black, sometimes orange.

Hab. Throughout India, except along the Malabar coast. *B. Stoliczkanus* takes its place in Burma. It rarely exceeds 4 inches in length.

47. BARBUS (*Puntius*) PUNCTATUS.

Puntius punctatus, Day, Proc. Zool. Soc. 1865, p. 302, and Fishes of Malabar, p. 214, pl. vii, f. 1.

Putter perlee, Mal.

B. III. D. 3/8, P. 15, V. 9, A. 2/5, C. 18, L. 1. 23, L. tr. 6/4.

Length of head 1/6, of caudal 1/6, height of body 1/3, of dorsal fin 1/5 of the entire length.

Eyes. Diameter nearly $1/2$ of length of head, $1/3$ of a diameter from end of snout, 1 diameter apart.

Fins. Dorsal osseous ray strong, serrated, the fin commences over the ventrals, and midway between end of snout and base of the caudal; its upper border slightly concave. Caudal emarginate.

Lateral line—complete, slightly concave in the first part of its course.

Colours. Olive green superiorly, becoming white on the abdomen. A diffused black spot on the twentieth and twenty-first scales of the lateral line. The anterior half of the fourth scale from the opercle, in the row next below the lateral line, black. Fins yellowish, dorsal and anal tipped with orange. Dorsal with two rows of black spots, and anteriorly a short intermediate one.

Hab. Malabar, it does not appear to exceed three inches in length.

48. BARBUS (*Puntius*) PHUTUNIO.

Cyprinus phutunio, Ham. Buch., Fish. Gang. pp. 319, 390; \*Cuv. and Val. xvi, p. 395.

Systomus leptosomus, McClell. Ind. Cyp. pp. 287, 387, pl. 44, f. 2, (from Ham. Buch. MSS.)

Systomus phutunio, Bleeker, Verh. Bat. Gen. Batav. xxv, Bengal, p. 128, and Cyp. and Cobit. in Nat. Verh. Holl. Maatsch. Haarl. 1864-65, p. 12, t. 4. f. 4.

Barbus „ \*Günther, Catal. vii, p. 154; Day, Proc. Zool. Soc. 1869, p. 375.

Barbus Cumingii, Günther, Catal. vii, p. 155.

Kudji-kerundi, Ooriah; *Phutuni pungti*, Beng.

B. III. D. $\frac{2-3}{8}$, P. 15, V. 9, A. $3/5$, C. 19, L. 1. 20—23, L. tr. 8—10.

Length of head $1/4$, of caudal $1/4$, height of body $1/3$ of the total length.

Eyes. Diameter $2/5$ of length of head, $3/4$ of a diameter from end of snout, 1 diameter apart.

Dorsal profile more elevated than the abdominal. Mouth small. Barbels absent.

Fins. Dorsal osseous ray serrated, the serratures often becoming indistinct in the adult: the fin commences opposite the ventrals, and midway between the end of the snout and the base of the

caudal, which latter is rather deeply forked.

Lateral line—incomplete, only extending along 3 or 4 scales, from it to the base of the ventral are 3 rows.

Colours. Reddish brown, with a black band passing from the back to opposite the middle of the pectoral fin : a second from the back to the posterior end of the base of the anal : two other lighter bands pass downwards, one from the anterior, the other from the posterior extremity of the dorsal. A dark band down the centre of the dorsal, another at the base of the caudal.

Hab. Orissa and through Bengal and Ceylon, attaining 3 inches in length.

49. *BARBUS (Puntius) NIGROFASCIATUS.*

Barbus nigrofasciatus, Günther, Catal. vii, p. 155.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 20.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{4}$, height of body $\frac{1}{4}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, nearly 1 diameter from the end of snout and apart.

Body oval, strongly compressed : interorbital space convex.

Mouth small, upper jaw the longest. Barbels absent.

Fins. Dorsal lower than the body, it commences opposite the ventrals, its osseous ray is of moderate strength and finely serrated. Caudal deeply forked.

Lateral line—complete, 3 rows of scales between it and the base of the ventrals.

Colours. Reddish, (this however may be a *post mortem* appearance, as seen in *B. filamentosus*), with a black band passing from eye to eye ; body with three vertical black bands, the first across the middle of the trunk, the second between the anterior portion of the dorsal to behind the base of the ventral, and the third on the free portion of the tail. Dorsal, anterior portion of ventral and anal black.

Hab. Southern Ceylon attaining $2\frac{1}{2}$ inches in length.

Its form much resembles that of *B. ticto*, which has not been recorded from Ceylon. It, however, entirely differs from it in colouration and in having a complete lateral line.

50. \*BARBUS (*Puntius*) GUGANIO.

Cyprinus guganio, Ham. Buch. Fishes, Ganges, pp. 338, 339, 392; \*Cuv. and Val. xvi, p. 445.

Gugani, Beng.

B. III. D. $2/8$, P. 12, V. 9, A. 7.

“Head oval, small, blunt and dotted. Mouth small. The jaws protrude in opening, the upper is the longest. \* \* The eyes are far forwards on the sides of the head and large.”

Fins. The dorsal is near the middle, its osseous ray is strong and serrated.

Scales. Large and firmly adherent.

Lateral line—incomplete.

Colours. The back dotted.

Hab. Gangetic provinces and Assam. It scarcely exceeds an inch and a half in length.

51. BARBUS (*Puntius*) STOLICZKANUS.

Barbus McClellandi, Day, Proc. Zool. Soc. 1869, p. 619, (not Cuv. and Val.)

B. III. D. $2/8$, P. 14, V. 9, A. $2/5$, C. 19, L. 1. 25, L. tr. $5/6$.

Length of head $1/6$, of caudal $1/5$, height of body $1/3$ of the total length.

Eyes. Diameter nearly $1/3$ of length of head, 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart.

Mouth small. Barbels absent.

Tæth, pharyngeal—crooked, 5, 3, $2/2$, 3, 5.

Fins. Osseous dorsal ray serrated but less strongly than in *B. ticto*, the serratures are likewise rather irregular, the fin commences midway between the snout and the base of the caudal, which latter is lunate.

Lateral line—complete, there are $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. Silvery, a black mark on the lateral line about the third scale, and a deep black mark above and a little behind the posterior extremity of the anal fin, superiorly it extends almost to the back, whilst it is yellow anteriorly. Fins orange.

Hab. Eastern Burma, where it entirely supersedes *B. ticto*. It attains four inches in length.

52. BARBUS (*Puntius*) PYRRHOPTERUS.

Systomus pyrrhopterus, McClell., Ind. Cyp. pp. 285, 383, pl. 44, f. 1; \*Cuv. and Val. xvi, p. 395.

Barbus pyrrhopterus, Günther, Catal. vii, p., 57.

B. III. D. 2/7, P. 12, V. 9, A. 7, C. 19, L. l. 22-24, L. tr. $4\frac{1}{2}/4\frac{1}{2}$.

Length of head $1/4$, height of body rather above $1/3$ of the total length. No barbels.

Fins. Osseous dorsal ray of moderate strength, serrated.

Lateral line—complete, 2 rows of scales between it and the base of the ventral fin.

Colours. A dark spot at the end of the lateral line just before the base of the caudal fin.

Hab. Upper Assam.

b. *Osseous dorsal ray entire.*

53. BARBUS (*Puntius*) STIGMA.

Systomus sophore, McClell., Ind. Cyp. pp. 285, 382; Jerdon, M. J. L. and S. 1849, p. 316, (not Ham. Buch.)

Leuciscus stigma, Cuv. and Val. xvii, p. 93, pl. 489; Jerdon, l. c. p. 317.

„ *sulphureus*, Cuv. and Val. xvii, p. 96.

Cyprinus sophore,\* Cuv. and Val. xvi, p. 388.

Barbus sophore, Günther, Catal. vii, p. 152.

Puntius modestus, Kner, Novara Fische, p. 348, t. 15, f. 3.

Barbus modestus, \*Günther, Catal. vii, p. 156.

Barbus stigma, Day, Proc. Zool. Soc. 1868, p. 198, 1869, p. 375.

Chadu-perigi, Tel.; *Patia-kerundi*, Ooriah; *Katcha-karawa* and *Pottiah*, Hin.; *Katch karawa*, Can.; *Nga-kkoon-ma*, Burm.

B. III. D. 3/8, P. 17, V. 9, A. 3/5, C. 19, L. l. 25, L. tr. 5/4, Vert. 15/14.

Length of head $1/5$, of caudal $1/5$, height of body $1/4$ of the total length.

Eyes. Diameter $1/4$ of length of head, $1\frac{1}{2}$ diameters from end of snout, 2 diameters apart.

Jaws equal in front. No barbels.

Teeth,—pharyngeal, crooked, 5, 3, $2/2$, 3, 5.

Fins. Osseous dorsal ray of moderate strength, entire, as long as the head without the snout; it commences over the

ventrals, and midway between the end of the snout and the base of the caudal.

Lateral line—complete, 3 to $3\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours. Silvery, with a scarlet lateral band at some seasons, and a dark mark across the base of the middle dorsal rays, this last being occasionally absent. A round black blotch, more or less distinct at the root of the caudal fin.

Hab. Throughout India and Burma. As food it is bitter.

In January 1868 I found 1850 developed ova in one female fish at Madras.

54. BARBUS (*Puntius*) CHRYSOPTERUS.

Systemus chrysopterus, McClell., Ind. Cyp. pp. 285, 383.

Barbus chrysopterus, Günther, Catal. vii, p. 152.

Pottiah, Punj.

B. III. D. $\frac{3}{8}$, P. 17, V. 9, A. $\frac{2}{5}$, C. 19, L. l. 23, L. tr. $\frac{5}{5}$.

Length of head and caudal fin each nearly $\frac{2}{9}$, height of body $\frac{1}{3}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of the head, $\frac{3}{4}$ of a diameter from end of snout.

Upper profile slightly concave over the nape, rising considerably to the base of the dorsal fin, and much more convex than that of the abdomen. Body compressed.

Mouth narrow, horse-shoe shaped, the upper jaw very slightly the longest, when the mouth is closed.

Fins. Dorsal arises slightly in advance of the ventral, and midway between the end of the snout and the base of the caudal, its smooth osseous ray is not strong and as long as the head without the snout; upper margin of the dorsal fin slightly concave, its height is only slightly above one-half of that of the body. The pectoral extends to the ventral, and the latter to the anal. Lower caudal lobe slightly the longest.

Lateral line—complete, $3\frac{1}{2}$ rows of scales between it, and the base of the ventral.

Colours. Dirty silvery, darkest along the back, and each scale having a dark base formed by fine black dots. Dorsal, ventral,

and anal fins stained with black spots at their extremities. A dark mark at the base of the 4th and 6th divided dorsal rays, sometimes a dark mark at base of the tail.

Hab. Assam, N. W. Provinces and Punjáb.

55. *BARBUS (Puntius) UNIMACULATUS*.

Systemus unimaculatus, Blyth, J. A. S. of Bengal, 1860, p. 159. Day, Proc. Zool. Soc. 1869, p. 557.

B. III. D. $3/8$, P. 11, V. 8, A. $2/5$, C. 19, L. 1. 24, L. tr. $4\frac{1}{2}/4\frac{1}{2}$.

Length of head $2/7$, height of body $1/3$ of the total length.

Eyes. Diameter $1/3$ of length of head, 1 diameter from end of snout and apart.

Mouth small, extending half the distance to below the orbit. No barbels.

Fins. Dorsal with an osseous, entire and weak, ray: it commences midway between the snout and the base of the caudal fin.

Lateral line, incomplete, becoming lost opposite the posterior extremity of the dorsal fin.

Colours. Silvery, a black mark at the base of each dorsal ray.

A number of fry up to $1\frac{8}{10}$ inches in length from the Tenasserim Provinces are in the museum; what they would be, when adults, it is difficult to determine, but probably (as the lateral line is incomplete) they never would grow large fish.

56. *BARBUS (Puntius) FILAMENTOSUS*.

Leuciscus filamentosus, Cuv. and Val. xvii, p. 95, pl. 492.

Leuciscus Mahecola, Cuv. and Val. xvii, p. 305, pl. 502 (young).

Systemus assimilis, filamentosus, et Maderaspatisensis, Jerdon, Madr. Journ. Lit. and Sc., xv, pp. 318, 319.

Puntius filamentosus, Day, Fish. Malabar, p. 215.

Barbus filamentosus, Günther, (? synom.) Catal. vii, p. 145.

B. III. D. $3/8$, P. 15, V. 9, A. $2/5$, C. 19, L. 1. 21, L. tr. $5/3$.

Length of head $1/5$, of caudal $1/4$, height of body $1/3$ of the total length.

Eyes. Diameter $2/5$ of length of head, $2/3$ of a diameter from end of snout.

Body strongly compressed. Generally large pores over the snout. No barbels.

Fins. Osseous dorsal ray smooth and feeble, whilst the divided ones are all more or less elongated in the adult.

Lateral line—complete, 2 rows of scales between it and the base of the ventral.

Colours. Silvery, each scale having a metallic green edging, whilst a more or less distinct black blotch exists on the lateral line before the base of the caudal fin. A very curious change occurs in this fish immediately after death, the whole of its body becoming scarlet. Caudal red, tipped with black.

Hab. Western coast and Southern India, attaining 6 inches in length.

Dr. Günther remarked “Valenciennes and other naturalists have overlooked the barbels in this species,” but I consider the Ceylon fish from which he drew up his description as belonging to *B. lepidus*, for *B. filamentosus* is destitute of barbels.

57. BARBUS (*Puntius*) TERIO.

Cyprinus terio, Ham. Buch., Fish. Gang. pp. 313, 389; \*Cuv. and Val. xvi, p. 398.

Systemus gibbosus, \*McClell., Ind. Cyp. pp. 286, 385, pl. 44, f. 7, (from Ham. Buch. MSS.)

Barbus terio, \*Günther, Catal. vii, p. 153; Day, Proc. Zool. Soc. 1869, p. 376.

Kakachia-kerundi, Ooriah; *Teri pungti*, Beng.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{3}{5}$, C. 19, L. 1. 21, L. tr. $\frac{5}{5}$.

Length of head $\frac{1}{4}$, of caudal $\frac{1}{4}$, height of body $\frac{1}{3}$, of dorsal $\frac{1}{4}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, 1 diameter from end of snout, $1\frac{1}{4}$ diameters apart.

Body compressed, dorsal profile more convex than the abdominal one, there being a considerable rise from the snout to the base of the dorsal fin. Upper jaw slightly the longest. No barbels.

Fins. Osseous dorsal ray moderately strong and entire; it arises slightly in advance of the ventrals, and midway between the end of snout and base of the caudal.

Lateral line—incomplete, ceasing after 3 or 4 scales.

Colours. Silvery, greenish along the back, and each scale having a number of fine black spots most numerous at the anterior

margin. A large black blotch in the middle of the side, over the posterior extremity of the anal, which sometimes is extended in the median line as far as the tail. A very indistinct black blotch under the posterior extremity of the dorsal passing downwards to the middle of the fish. Fins with a yellowish tinge, stained at their margins.

Hab. Orissa and Bengal, attaining 3 or 4 inches in length.

58. \**BARBUS (Puntius) DUVAUCELI*.

Leuciscus Duvaucelii, Cuv. and Val. xvii, p. 95, pl. 491.

Systomus Duvaucelii, \*Bleeker, Prod. Cyp. p. 278, (no description).

Barbus Duvaucelii, \*Günther, vii, p. 151.

B. III. D. $2/8$, A. $2/5$, L. 1. 27.

According to the figure the length of the head is $1/5$, of caudal about $2/9$, height of body $1/3$ of the total length.

Eyes. About $1/4$ of length of head, 1 diameter from end of snout.

Fins. Dorsal commences rather nearer the base of the caudal than to the end of the snout, its osseous ray entire. Caudal forked.

Lateral line—complete.

Colours. A black spot at the end of the lateral line just anterior to the base of the caudal fin.

Hab. Bengal.

59. *BARBUS (Puntius) VITTATUS*.

Puntius vittatus, Day, Proc. Zool. Soc. 1865, p. 303; Fish. Malabar, p. 215, pl. 13, f. 1.

Barbus vittatus, Günther, Catal. vii, p. 156.

Kooli, Hind.

B. III. D. $2/8$, P. 12, V. 9, A. $2/5$, C. 20, L. 1. 20-22, L. tr. $4/3$.

Length of head $2/9$, of caudal $2/7$, height of body $1/3$ of the total length.

Eyes. Diameter $1/2$ of length of head, $2/3$ of a diameter from end of snout, 2 diameters apart.

Fins. Dorsal ray osseous, weak, and entire; it commences somewhat in advance of the ventrals, and midway between the snout and the base of the caudal fin, the latter being forked.

Lateral line—incomplete, ceasing after about five scales.

Colours. Silvery, generally with four black spots in the adult, one just before the dorsal, one below its posterior margin, another at the base of the caudal and a fourth at the base of the anal. The dorsal has a vertical black streak, and a black tip with orange markings. In the immature the colours vary; when the fish is about eight-tenths of an inch long, a vertical stripe begins to show itself in the posterior third of the dorsal fin, the summit of which also becomes edged with black, whilst there is some irregular orange colouration about the fin; a black spot shows itself at the base of the caudal and anal fins, and in very young specimens the line of demarcation between the green of the back, and the silvery abdomen, appears like a white band running from the eye to the middle of the tail.

Hab. Mysore and Malabar, attaining $1\frac{1}{2}$ inches in length.

c. *Without osseous dorsal ray,*

60. BARBUS (*Puntius*) PUNJAUBENSIS.

B. III. D. $\frac{3}{8}$, V. 9, A. $\frac{2}{5}$, C. 19, L. 1. 43, L. tr. 8/?

Length of head $\frac{2}{11}$, of caudal $\frac{1}{4}$, height of body $\frac{2}{7}$ of the total length.

Eyes. Rather large, situated in the anterior half of the head, $\frac{1}{3}$ of a diameter from end of snout.

Mouth small, horse shoe shaped, with the upper jaw slightly over-hanging the lower. Abdominal profile more convex than that of the back. Barbels absent.

Fins. Dorsal two-thirds as high as the body below it, arising midway between the snout and the base of the caudal fin, its last undivided ray is weak and articulated. Caudal deeply forked, with pointed lobes.

Lateral line—incomplete.

Colours. Silvery, with a burnished silvery stripe along the side, and a black spot at the base of the caudal fin. Two first dorsal rays and intermediate membrane deep black.

Hab. Ravi river at Lahore; it is a small species, attaining about 2 inches in length. Rapidly putrifying, nearly all my specimens were spoiled before I was able to put them into spirit.

61. BARBUS (*Puntius*) COSUATIS.

Cyprinus cosuatis, Ham. Buch., Fish. Gang. pp. 338, 392; \*Cuv. and Val. xvi, p. 444.

Systomus malacopterus, McClell., Ind. Cyp. pp. 287, 386, pl. 44, f. 9, (from H. B. MSS.)

Rohtee pangut, Sykes, Trans. Zool. Soc. ii, p. 365.

Leuciscus cosuatis, Bleek., Verh. Bat. Gen. Ned. Ind. xxv, 1853, p. 139.

Barbus cosuatis, Günther, Catal. vii, p. 157.

Koswati, Beng.

B. III. D. $3/8$, P. 13, V. 9, A. $2/5$, C. 19, L. l. 22, L. tr. 6.

Length of head $1/4$, of caudal $1/4$, height of body nearly $1/3$ of the total length.

Eyes. Diameter $2/5$ of length of head, $1/2$ a diameter from end of snout, 1 diameter apart.

Fins. Dorsal without any osseous ray, it commences midway between the end of the snout and the base of the caudal fin.

Lateral line—incomplete, the row of scales on which it is situated is larger than the others.

Colours. Silvery, the scales having dark margins, the top of the dorsal, and a spot across the middle of the anterior anal rays, of a black colour.

Hab. Bengal, attaining 2 or 3 inches in length, also found in the North West Provinces.

62. \*BARBUS (*Puntius*) PRESBYTER.

Leuciscus presbyter, Cuv. and Val. xvii, p. 307.

B. III. D. 11, A. 7, L. l. 26, L. tr. $6/2$.

Length of head $2/9$, height of body $2/9$ of the total length. Profile of back straight, that of the abdomen convex. The upper jaw slightly longer than the lower.

Fins. No strong ray in the dorsal fin; anal small; the caudal not deeply lobed.

Lateral line—concave.

Colour. Back greenish, sides silvery, no spots, dorsal slightly edged with black.

Hab. Bombay; although placed here amongst the barbels its right to the position appears doubtful.

63. BARBUS (*Puntius*) PUNTIO.

Cyprinus puntio, Ham. Buch., Fish Ganges, pp. 318, 389.

Barbus puntio, \*Günther, Catal. vii, p. 154; Day, Proc. Zool. Sec. 1870 p. 100.

B. III. D. $\frac{3}{8}$, P. 15, V. 9, A. $\frac{2}{5}$, C. 21, L. 1. 23, L. tr. $\frac{4}{4}$.

Length of head $\frac{1}{4}$, of caudal $\frac{2}{7}$, height of the body nearly $\frac{1}{3}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, $\frac{3}{4}$ of a diameter from end of snout; 1 diameter apart.

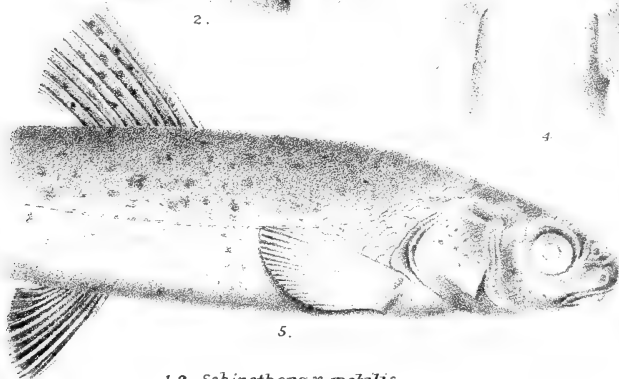
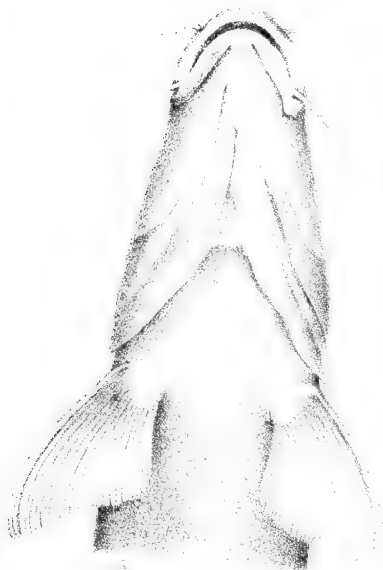
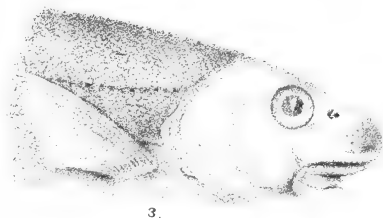
Dorsal profile considerably elevated. Mouth small. No barbels.

Fins. Last undivided dorsal ray weak, entire, and not osseous; the fin commences rather in advance of the ventrals, and midway between the anterior margin of the orbit and the base of the caudal, the latter fin deeply forked.

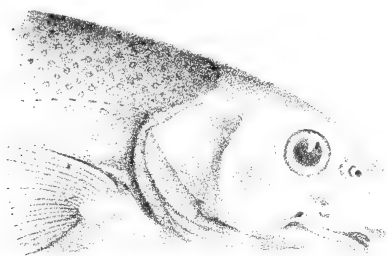
Lateral line—incomplete, only extending along a few scales; $2\frac{1}{2}$ rows between it and the base of the ventral fin.

Colours. Silvery, a wide black band encircles the free portion of the tail, and includes the tip of the anal fin. Dorsal orange, tipped with black.

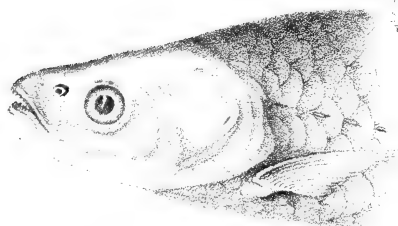
Hab. Bengal and British Burma. It only attains about 3 inches in length.



1. 2. *Schizothorax nobilis*.
 3. 4. *Oreinus sinuatus*.
 5. *Schizopygopsis Stolickæ* (from Steind.)



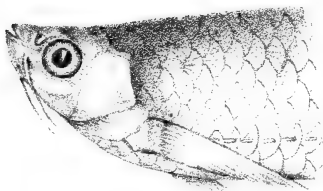
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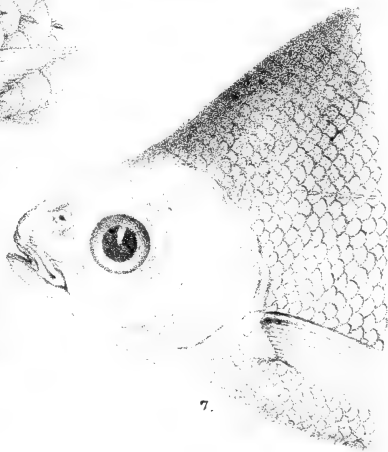
5.



4.



6.



7.

- 1-2. *Diptychus maculatus*.
 3. *Ptychobarbus conirostris* (from Steind.)
 4. *Aspidoparia morax*.
 5. *Rasbora nielgherriensis*.
 6. *Nuria danrica*.
 7. *Rohitee cotio*.

List of Errata in Part II, Journal for 1871.

Page 175, line 16, for "rest" read "rests."

" " " " for "appear" read "appears."

" 176 " 5 for "bent" read bend."

" " " 9 for "food" read "foot."

" 190 " 28 for "Gecarcinuca" read "Gecarcinucus."

" 241 " 34 for "palmira" read "palmaria."

" 446 " 29 for "No. 84" read "No. 86."

" 448 " 7 for "No. 84" read "No. 86."

" " " 9 for "No. 84" read "No. 86."



THE HISTORY OF THE CITY OF BOSTON

FROM THE FIRST SETTLEMENT
TO THE PRESENT TIME
BY
JOHN B. HENNING, ESQ.
OF THE CITY OF BOSTON.
IN TWO VOLUMES.
VOL. I.
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JOURNAL
OF THE
ASIATIC SOCIETY.

PART II.—PHYSICAL SCIENCE.

No. IV.—1871.

MONOGRAPH OF INDIAN CYPRINIDÆ, PT. III,—by Surgeon F. DAY.
(With plates XXII and XXIII.)

[Received 17th August, 1871.—Continued from p. 336.]

GENUS SCHIZOTHORAX, *Heckel*. Pl. xxii, f. 1, 2.

Racoma, sp. McClell.

Schizopyge, sp. Heckel.

Opistocheilus, pt. Bleeker.

Abdomen rounded. Snout conically rounded, and laterally somewhat compressed, with the mouth arched and antero-inferior, mandibles neither broad, flattened, nor with sharp margins, its edge sometimes having a thin, deciduous horny covering.\ Barbels four. Pharyngeal teeth pointed, hooked, 5, 3, 2/2, 3, 5. Dorsal fin rather short, with a strong, osseous, serrated ray, and arising opposite the ventrals; anal short. Scales very small, the vent and base of the anal fin in a sheath, covered by enlarged, tiled, scales. Lateral line passing to the centre of the base of the caudal fin.*

Geographical distribution. Mountain streams and rivers around the bases of the Himalayas, also in Cashmere, Nepaul, and Afghanistan.

\* This horny covering is very liable to become detached and lost after death, it should be carefully investigated in fresh specimens.

7
SYNOPSIS OF SPECIES.

1. *Schizothorax barbatus*, D. 4/8, A. 3/5, Cabul.
2. „ *niger*, D. 4/8, A. 3/5, Cashmere.
3. „ *intermedius*, D. 4/8, A. 3/5, Afghanistan.
4. „ *Ritchianus*, D. 3—4/8, A. 2/5, Afghanistan.
5. „ *nobilis*, D. 3/9, A. 8, Afghanistan and Nepaul.
6. „ *planifrons*, D. 4/7, A. 2/5, Cashmere.
7. „ *Hodgsonii*, D. 3/8, A. 2/5, L. 1. 155, Himalayas.
- \* 8. „ *labiatus*, D. 3/8, A. 7, Afghanistan.
- \* 9. „ *chrysochlorus*, D. 3/8, A. 8, Afghanistan.
- \* 10. „ *gobioides*, D. 3/8, A. 6, Bamean river.
11. „ *curvifrons*, D. 11, A. 8, L. 1. 100, Cashmere.
- \* 12. „ *nasus*, D. 11, A. 8, Cashmere.
13. „ *Hügelii*, D. 11, A. 8, L. 1. 190, Cashmere.
- \* 14. „ *micropogon*, D. 11, A. 8, Cashmere.
- \* 15. „ *Edeniana*, D. 3/8, A. 8, Afghanistan.
- \* 16. „ *longipinnis*, D. 11, A. 8, Cashmere.
17. „ *esocinus*, D. 3/8, A. 3/5, Cashmere and Afghanistan.
- \* 18. „ *brevis*, D. 2/7, A. 7, Afghanistan.

Amongst the foregoing 18 species, it is very, or rather most, probable that several will eventually turn out to be synonyms.

1. SCHIZOTHORAX BARBATUS.

McClell., Cal. Journ. Nat. Hist. ii. 1842, p. 580; Günther Catal. vii. p. 168.

B. III. D. 4/8, P. 21, V. 11, A. 3/5, C. 21.

Length of head 1/5, caudal 1/5, height of body 1/5 of the total length.

Eyes. Diameter 1/4 of length of head, 1 1/4 diameters from end of snout.

Interorbital space very slightly convex. Mouth inferior, semi-oval; cleft nearly horizontal, about equalling that of the gape; upper jaw slightly the longest; inside of lower jaw said to be covered with a deciduous cartilaginous layer (the specimens in the British Museum which I saw, had their mouths firmly closed). Lower labial fold entire, and having a free margin in its entire extent. Barbels as long as the orbit.

Fins. Dorsal commences midway between the anterior margin of the orbit and the base of the caudal; its osseous ray strong, as

long as the head, and posteriorly with closely set denticulations; anal when laid flat does not extend so far as the base of the caudal.

Scales—minute, anal row but little developed.

Colours—silvery.

Hab. Cabul river at Jellalabad, attaining at least 11 inches in length.

2. SCHIZOTHORAX NIGER.

Heckel, *Fische aus Kaschmir*, p. 29, t. 5; \*Cuv. and Val. xvi, p. 217; Günther, *Catal.* vii. p. 164.

Alghad, Cash.

B. III. D. 4/8, P. 19, V. 10, A. 3/5, C. 19.

Length of head about $1/5$ ($4/21$), of caudal $1/6$, height of body $1/5$ of the total length.

Eyes. Diameter $2/9$ of length of head, very little more than 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart.

Mouth horse-shoe shaped, inferior, the upper jaw somewhat projecting, cleft nearly horizontal, but not so long as the gape. Margin of the lower jaw cutting, its inside covered with a horny cartilaginous layer. Lower labial fold interrupted. Barbels shorter than the eye.

Fins. Dorsal arises midway between the anterior margin of the orbit and the base of the caudal, also a little before the root of the ventral; its osseous ray is moderately strong, as long as the head without the snout, and having posteriorly coarse and rather closely set denticulations. Anal fin when laid flat not reaching the base of the caudal which latter is forked.

Scales—minute, anal row but little developed, the largest being one-third as broad as the orbit.

Hab. Cashmere, attaining at least seven inches in length.

3. SCHIZOTHORAX INTERMEDIUS.

McClell., *Cal. Journ. Nat Hist.* ii, 1842, p. 579; Günther, *Catal.* vii p. 165.

B. III. D. 4/8, P. 17, V. 11, A. 3/5, C. 19.

Length of head $1/5$, of caudal $1/5$, height of body about $1/5$ of the total length.

Eyes. Diameter $1/6$ of length of head, nearly 2 diameters from end of snout and apart.

Interorbital space flat, mouth inferior, crescentic, with the cleft nearly horizontal, and the gape one half greater in extent than the cleft. Snout overhanging the upper jaw which projects beyond the lower, the edge of the latter rather sharp, and its inside covered with a deciduous cartilaginous layer. Lower labial fold interrupted in the middle. Barbels about as long as the eye.

Fins. Dorsal commences midway between the end of the snout and the base of the caudal, and slightly in advance of the ventrals; its osseous ray is of moderate strength, rather more than half as long as the head and closely serrated posteriorly. The anal when laid flat reaches the root of the caudal.

Scales—minute, anal row moderately developed, the largest being almost half as broad as the orbit.

Hab. Afghanistan, attaining at least 11 inches in length.

4. SCHIZOTHORAX RITCHIANUS.

McClell., Cal. Journ. Nat. Hist. ii, 1842, p. 580; Günther, Catal. vii, p. 168.

B. III. D. $\frac{3-4}{8}$, P. 19, V. 11, A. $2/5$, C. 21.

Length of head $2/9$, of caudal $2/9$, height of body $1/5$ of the total length.

Eyes. Diameter $1/5$ of length of head, $1\frac{3}{4}$ from end of snout, $1\frac{1}{4}$ diameters apart.

Mouth inferior, semi-oval, the jaws equal in front. Lower labial fold entire, and having a free margin in its entire extent, which, however, is produced into a short median lobe. Interorbital space nearly flat. Barbels nearly as long as the eye.

Fins. Dorsal commences midway between the anterior margin of the orbit and the base of the caudal; its osseous ray is serrated posteriorly, rather feeble, and the stiff portion as long as the head without the snout; anal when laid flat does not quite reach the base of the caudal, which latter is lunate.

Scales—minute, anal row moderately developed.

Colours—silvery and spotted with black.

Hab. Afghanistan, attaining at least nine inches in length.

5. SCHIZOTHORAX NOBILIS, pl. xxii, fig. 1, 2.

Racoma nobilis, \*McClelland, Cal. J. N. H., vol. ii, p. 577, pl. xv, fig. 4.

B. III. D. 3/9, P. 19, V. 11, A. 3/5, C. 19.

Length of head 1/4, of caudal 1/5, height of body 1/5 of the total length.

Eyes. Diameter 1/9 of length of head, 3 diameters from end of snout, $2\frac{1}{2}$ diameters apart.

Head elongated and compressed, upper jaw slightly the longest. Opercle rounded posteriorly. Cleft of mouth nearly horizontal. In a fine specimen 15 inches long, from Nepaul, now in the Calcutta Museum, there is no horny envelope to the lower jaw, but short longitudinal bands of horny substance are present inside both jaws; these of course may have been attached to a horny covering which has become lost. Rostral barbels as long as one and a half diameters of the orbit, and slightly longer than the maxillary ones. Lower labial fold interrupted in the middle.

Fins. Dorsal commences midway between the eye and the base of the caudal; its spine is strong, not quite half as long as the head, and posteriorly rather feebly serrated. Anal when laid flat, does not reach the caudal, which latter is deeply forked.

Scales in tiled row moderately developed, and two thirds as long as the orbit.

The entire length of the intestinal canal, according to McClelland, is only one and two two-thirds the length of the body.

Colours—silvery, the whole body and fins covered with numerous small spots.

Hab. Afghanistan and Nepaul, attaining 18 inches in length.

6. SCHIZOTHORAX PLANIFRONS.

Heckel, Fische aus Kashmir, p. 44, t. 8, fig. 2; \*Cuv. & Val. xvi, p. 221; Günther, Catal. vii, p. 163.

B. III. D. 4/7, P. 21, V. 11, A. 2/5, C. 21.

Length of head 2/9, of caudal 2/11, height of body 2/9 of the total length.

Eyes. Diameter 1/5 of length of head, $1\frac{1}{2}$ diameters from end of snout and apart.

Interorbital space flat, the nuchal region somewhat prominent. Mouth anterior, cleft descending obliquely downwards, the jaws equal in front, the edge of the mandible not cutting, and having an internal covering of thin, deciduous, cartilage; the lower labial fold interrupted in the middle, where there are a pair of large open glands. Barbels about as long as the eye.

Fins. The dorsal commences midway between the posterior extremity of the orbit and the base of the caudal, its osseous ray is moderately strong, two-thirds as long as the head, and coarsely serrated posteriorly. Anal nearly reaching the caudal when laid backwards, whilst the latter fin is truncated.

Scales—minute, except the anal row which is moderately developed, the largest being half as broad as the orbit.

Colours—silvery.

Hab. Cashmere, attaining at least 14 inches in length.

7. SCHIZOTHORAX HODGSONII.

Günther, Catal. vii, p. 167.

Oreinus Hodgsonii, Günther, Proc. Zool. Soc. 1861, p. 224.

Dinnawah, Hind. (N. W. P.)

B. III. D. $3/8$, P. 19, V. 11, A. $2/5$, C. 19, L. 1. 155.

Length of the head and caudal each, about $1/5$ ($4/21$), height of body $1/6$ of the total length.

Eyes. Diameter $1/4$ of length of head, $1\frac{1}{2}$ diameters from end of snout.

Interorbital space slightly convex, snout pointed. Mouth inferior, breadth of gape equalling the depth of the cleft, the upper jaw projecting and having a broad fleshy lip with a free superior margin. Edge of lower jaw slightly compressed, having internally a thin deciduous cartilaginous layer; lower labial fold broad, free in its whole circumference, and having a small median lobe. Barbels about as long as the eye.

Fins. Dorsal commences in advance of the ventrals, and midway between the end of the snout and the root of the caudal, its osseous ray is nearly as long as the head, strong, and armed with coarse denticulations. Anal when laid flat nearly reaches the base of the caudal, which last is deeply forked.

Scales in tiled row but little developed, the largest not being quite half as broad as the orbit.

Colours—uniform silvery, sometimes with a few fine spots.

Hab. Himalayas, attaining at least twenty inches in length. Also at Hurdwar where the Ganges leaves the hills.

8. SCHIZOTHORAX LABIATUS.

Racoma labiatus, McClell., C. J. N. H., vol. ii, p. 578, pl. xv, fig. 1.

B. III. D. $4/8$, P. 10, V. 10, A. $2/5$, C. 21.

Length of head greater than the height of body, and $1/4$ of the total excluding the caudal fin.

Eyes. Diameter $2/15$ of length of head, 3 diameters from end of snout.

Head much compressed, interorbital space slightly convex, upper jaw the longest. Labial fold entire, and prolonged into a lobe in the centre. Maxillary barbels one and a half times as long as the orbit. McClelland observes they end in trident points.

Fins. Dorsal commences midway between the anterior margin of the orbit and the base of the caudal fin. Anal when laid flat almost reaches the base of the caudal.

Scales in tiled row two-thirds as broad as the orbit.

Colours. Uniform silvery.

Hab. Peshut, Koonar river near Jellalabad.

9.\* SCHIZOTHORAX CHRYSOCHLORUS.

Racoma chrysochlora,\* McClell., Cal. J. N. H., vol. ii, p. 577, pl. xv, fig. 12.

B. III. D. $3/8$, P. 19, V. 10, A. 8.

“Mouth directed forwards, intermaxillaries protractile, without spots, scales small, raised on the lateral line, vertical anal scales large, colour brownish yellow. Operculum square behind. Intestines convoluted in a conical form in the anterior part of the abdomen, and equal to six lengths of the body.”

Hab. Lolpore, Cabul river, attaining 10 inches in length.

10. SCHIZOTHORAX GOBIOIDES.

Racoma gobioides, McClell. C. J. N. H. ii, p. 576, pl. 15, f. 3.

B. III. D. $\frac{3}{7\frac{1}{8}}$, P. 19, V. 9, A. $\frac{2}{5}$, C. 19.

Length of head $1/5$, of caudal $1/6$, height of body rather above $1/5$ of the total length.

Eyes. Diameter $1/5$ of length of head, $1\frac{3}{4}$ diameters from end of snout, 2 diameters apart.

Snout rounded and but little prominent, the mouth opens horizontally, and the intermaxillary has but little motion. A thin deciduous horny covering exists inside the lower jaw, and the lower labial fold is interrupted in the middle. Barbels longer than the orbit.

Fins. The dorsal arises somewhat in advance of the ventrals, midway between the eye and the commencement of the caudal, its osseous ray is moderately strong and serrated, and as long as the head without the snout; the anal fin laid flat reaches the base of the caudal.

Scales. The tiled row but little developed, the scales composing it are about thrice the depth of the ordinary scales on the other parts of the body.

Colour. Yellowish brown, darker on the back, and becoming yellowish white below. Very fine black points on the scales.

Hab. Barmean river, also Nepaul, attaining at least $8\frac{1}{2}$ inches in length.

11. SCHIZOTHORAX CURVIFRONS.

Heckel, Fische aus Kasch. p. 25, t. 3; \*Cuv. and Val. xvii, p. 216; \*Günther, Catal. vii, p. 164.

Sottir, Cash.

B. III. D. $3/8$, P. 19, V. 11, A. $2/5$, C. 19, L. 1, 100.

Length of head $1/5$, height of body rather above $1/5$ of the total length.

Eyes. Diameter $1/5$ of length of head, $1\frac{1}{4}$ diameters from end of snout.

Interorbital space nearly flat. Mouth small, crescentic, a little wider than deep, cleft slightly oblique, upper jaw the longest. Lower jaw with a sharp edge, and a very thin horny covering. Lower labial fold interrupted. Barbels as long as the eye.

Fins. Dorsal arises nearly midway between the anterior margin of the orbit and the base of the caudal, its osseous serrated ray is of moderate strength, as long as the head without the snout; the anal when laid backwards does not quite reach the base of the caudal.

Scales—minute, those along the lateral line largest; anal row but little developed.

Colour—silvery.

Hab. Cashmere.

12. \*SCHIZOTHORAX NASUS.

Heckel, *Fische aus Kasch.* p. 33, f. 6; \*Cuv. and Val., xvi, p. 218; Günther, *Catal.* vii, p. 166.

Dongu, Cash.

B. III. D. 11, A. 8.

Length of head $\frac{2}{9}$, height of body a little above $\frac{2}{9}$ of the total length.

Eyes. Diameter $\frac{1}{6}$ of the length of head, more than 1 diameter from end of snout.

Mouth inferior, crescentic, cleft nearly horizontal, and not so long as the gape, upper jaw somewhat compressed, and projecting beyond the lower, margin of mandibles sharp, with the lower labial fold interrupted.

Fins. Dorsal arises midway between the end of the snout, and the root of the caudal, its osseous ray is of moderate strength, and armed posteriorly with some rather widely set denticulations. Anal, when laid flat, not extending to the root of the caudal.

Scales—minute; anal row moderately developed, the largest scales in it being half as broad as the orbit.

Hab. Cashmere; attaining at least 11 inches in length.

13. SCHIZOTHORAX HÜGELII.

Heckel, *Fische aus Kaschmir*, p. 36, t. 7; \*Cuv. and Val., xvi, p. 219; \*Günther, *Catal.* vii, p. 164.

Grot, Cash.

B. III. D. $\frac{3}{8}$, P. 21, V. 10, A. $\frac{2}{5}$, L. 1. ca. 190.

Length of head $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{2}{9}$ of the total length without the caudal fin.

Eyes. Diameter $\frac{1}{6}$ of length of head, $2\frac{1}{2}$ diameters from end of snout and apart.

Gape of mouth horse-shoe shaped, as broad as deep, cleft oblique, upper jaw the longest. Edge of lower jaw with a thin but sharp

horny covering. Lower labial fold uninterrupted, but with the central portion transverse. Barbels rather longer than the eye.

Fins. Dorsal commences midway between the eye and the root of the caudal, its osseous ray is strong and but slightly serrated, the stiff portion being as long as the head without the snout, anal, when laid flat, reaches the base of caudal, the latter fin forked in its last half and having pointed lobes.

Scales in anal row very large, the largest broader than the eye.

Colours. Silvery, upper parts with blackish dots.

Hab. Cashmere and Nipál, attaining at least 16 inches in length.

14. \*SCHIZOTHORAX MICROFOGON.

Heckel, *Fische aus Kaschmir*, p. 41, t. 8, fig. 1; \*Cuv. & Val., xvi, p. 220; Günther, *Catal.* vii, p. 163.

Ramghurdi, Cash.

B. III. D. 11, A. 8.

Length of head $1/4$, height of body $1/5$ of the total without the caudal fin.

Eyes. Diameter $2/9$ of length of head.

Opening of mouth small, crescentic, with an oblique cleft, and the jaws anteriorly of equal length. Margin of lower jaw rounded, and said to be without any horny covering. Lower labial fold interrupted. Barbels minute.

Fins. Dorsal arises nearer the root of the caudal than the end of the snout, its osseous ray strong and coarsely serrated. Anal, when laid flat, not reaching the caudal.

Scales in anal row but little developed, the other scales minute.

Hab. Cashmere; attaining 6 inches in length.

15. \*SCHIZOTHORAX EDENIANA.

Schizothorax Edeniana, McClell., *Cal. J. N. H.* ii, p. 579.

B. III. D. $3/8$, P. 20, V. 10, A. 8, C. 19.

Reflected margin of lower lip entire, lips thick, round, and soft, snout depressed. Lower jaw broad at the base, but narrow at the apex. Posterior margin of the opercle rounded.

Fins. Dorsal spine slender, soft, but harder at the base, where it is slightly serrated.

Scales. Rather above the ordinary size in this group.

Intestinal canal is $3\frac{1}{2}$ lengths of the body.

Hab. Cabul river at Koti-i-Ashruf, Mydan valley, and Sir-i-Chusmah.

16. \*SCHIZOTHORAX LONGIPINNIS.

Heckel, *Fische aus Kasch.* p. 27, t. 4; \*Cuv. & Val., xvi, p. 216; \*Günther *Catal.* vii, p. 166.

Dapeghat, Cash.

B. III. D. 11, A. 8.

Height of body equals the length of the head, which is $\frac{2}{9}$ of the total length, excluding the caudal fin.

Eyes. Diameter $\frac{1}{5}$ of length of head, rather above 1 diameters from end of snout.

Mouth crescentic, inferior, the cleft rather oblique but not equalling the gape, upper jaw slightly the longest. Margin of lower jaw rather sharp. Lower labial fold interrupted. Barbels shorter than the eye.

Fins. Dorsal commences a little nearer to the root of the caudal than the end of the snout, its osseous ray is moderately strong, and closely denticulated posteriorly. Anal, when laid flat, reaching the root of the caudal.

Scales—minute; anal row not much developed, the largest scales in it being less than half as broad as the orbit.

Hab. Cashmere, attaining at least ten inches in length.

17. SCHIZOTHORAX ESOCINUS.

Heckel, *Fische aus Kasch.* p. 48, t. 9; McClell., *Calc. Journ. Nat. Hist.* ii, 1842, p. 579; \*Cuv. and Val., xvi, p. 221; Günther, *Catal.* vii, p. 166.

Cheroo, Cash.

B. III. D. $\frac{3}{8}$, P. 18, V. 11, A. $\frac{3}{5}$, C. 19.

Length of head $\frac{1}{4}$, height of body $\frac{1}{4}$ of total length exclusive of the caudal fin.

Eyes. Diameter $\frac{1}{5}$ of length of head, $1\frac{1}{2}$ diameters from end of snout.

Cleft of mouth slightly oblique, the upper jaw a little longer than the lower. Margin of the lower jaw smooth and without

any cartilaginous membrane. Length of cleft of mouth equals that of the gape. Interorbital space flat. Lower labial fold interrupted. Barbels longer than the eye.

Fins. Dorsal commences between the anterior extremity of the snout, and the base of the caudal, its osseous ray is stout, nearly as long as the head, and posteriorly with strong, closely set denticulations. Anal, when laid flat reaches base of caudal, which latter is forked.

Scales—minute, the anal row moderately developed, the largest scales in it being half as broad as the orbit.

Colours. Body with numerous blackish dots.

Hab. Cashmere and Afghanistan, attaining at least ten inches in length.

18. \*SCHIZOTHORAX BREVIS.

Racoma brevis, McClelland, Cal. J. N. H. ii, p. 578.

B. III. D. 2/7, P. 20, V. 11, A. 7, C. 19.

Head short and compressed. The depth of the body nearly equal to one third of its length.

Lips covered with a thick fleshy membrane which forms a loose appendage to the lower jaw.

Fins—small, the fin membranes, strong, the rays slender, and the dorsal spine slender and soft.

Hab. Helmund river.

Genus. OREINUS, *McClell.* Pl. xxii, f. 3, 4.

SCHIZOTHORAX, Sect. A, *Heckel.*

SCHIZOPYGE, sp. *Heckel.*

Abdomen rounded. Snout rounded, mouth inferior and transverse, mandibles short, broad, and flat, loosely joined together at the symphysis, margin of the lower jaw having a thick horny covering, thickest internally, and a thick fringed lower lip with a free posterior edge, forming a sucker (\). Barbels four. Pharyngeal teeth pointed, hooked, 5, 3, 2/2, 3, 5. Dorsal fin rather short, with a strong, osseous, serrated*

\* The fact, that the large lower lip in *Oreinus* formed a sucker with its free posterior edge, has only been ascertained by me since the commencement of this Monograph was printed, and this will account for the genus being placed here, instead of following *Discognathus*.

ray, and arising opposite the ventrals; anal short. Scales very small, the vent and base of the anal fin in a sheath covered by enlarged tiled scales. Lateral line passing to the centre of the base of the caudal fin.

Geographical distribution. Mountain streams of Himalayas, Cashmere, Nipál and Afghanistan.

Synopsis of species.

- \*1. *Oreinus progastus*, D. 12, A. 7, Assam.
2. „ *sinuatus*, D. 4/7, A. 3/5. Anal scales about 1/2 as large as orbit. Black spots on body. Cashmere, Punjáb, Afghanistan.
3. „ *plagiostomus*, D. 3/8, A. 3/5. Anal scales about as large as orbit. Colouration uniform Cashmere and Afghanistan.
4. „ *Richardsonii*, D. 3/8, A. 3/5, L. 1. 140. Anal scales nearly as large as orbit. Colouration uniform. Nipál.

Geographical distribution. Throughout the Continent of India Ceylon and Burma.

1. \*OREINUS PROGASTUS.

McClelland, Ind. Cyp. pp. 274, 343, pl. 40, f. 4; \*Cuv. and Val., xvi, p. 225.

Adooe, Assam.

B. III. D. 12, P. 13, V. 10, A. 7, C. 19.

This species is “known by its lengthened and fleshy snout, small mouth, and the suborbital bones form a narrow band below and behind the eyes.”

Fins. “Dorsal anterior to the middle of the body, with a strong ensiform spine, toothed behind.”

“Abdomen abruptly enlarged beneath the pectorals.”

Hab. Assam along its borders, where the stream is too rapid to permit of navigation. It attains from 6 to 8lbs. in weight.

This fish “is said by the natives of Assam to occasion swimming of the head and temporary loss of reason for several days, without any particular derangement of the stomach.” It “tends rapidly to decay after death, and in the abdominal cavity a copious oily secretion is found, which is probably the cause of its bad effects.”

2. OREINUS SINUATUS, pl. xxii, fig. 3, 4.

Schizothorax sinuatus, Heckel, Fische aus Kaschmir, p. 21, t. 2.

Oreinus maculatus, McClell., Ind. Cyp. pp. 274, 345, pl. lvii, fig. 6, and Cal.

J. N. H. ii, p. 580.

„ *guttatus*, McClell., Ind. Cyp. pp. 273, 344, pl. xxxix, fig. 1; \*Cuv. and Val., xvi, p. 266.

„ *sinuatus*, Günther, Catal. vii, p. 161.

Gool-goolli and *Saul*, Punj.; *Jis*, Cash.

B. III. D. $\frac{3-4}{7-8}$, P. 17, V. 10, A. $\frac{2-3}{5}$, C. 19, L. l. 105, Vert. $\frac{24}{23}$.

Length of head 2/11, of caudal 2/11, height of body 2/11 of the total length.

Eyes. Diameter 2/9 to 1/6 of length of head, 2 to 2½ diameters from end of snout, 2¼ diameters apart.

Interorbital space broad and rather convex; snout rounded, with a very slight appearance of pores. Mouth inferior, transverse; lower lip well developed, rugose, entire, having a free posterior edge, and forming an adhesive sucker.

Inner side of lower lip covered with cartilage, which is extended on to its inferior surface, where however, it is not so horny. Barbels of about equal length and nearly as long as the eye. Pre-opercle with an emarginate posterior border.

Teeth,—pharyngeal, 5, 3, 2/2, 3, 5, crooked, pointed.

Fins. Dorsal commences opposite the ventrals, and midway or slightly nearer to the snout than it does to the base of the caudal fin, its spine is rather strong, moderately serrated and as long as the head without the snout, the fin is hardly so high as the body below it. Pectoral four-fifths as long as the head, and scarcely extending above halfway to the ventrals, which last reach two-thirds of the distance to the anal. The anal has a narrow base and its length slightly varies, reaching, when laid flat, the whole or only three-fourths of the distance to the base of the caudal, which is lobed in its posterior half. Free portion of tail slightly longer than deep.

Scales—smallest below the lateral line; tiled row to vent minute, each scale in it being scarcely one-third the diameter of the orbit.

Viscera. The diameter of the posterior portion of the air bladder

is small. The lobes of the liver are elongated, extending to opposite the anal fin, and having several lateral but parallel prolongations. In May (at Chumba) the ova of these fish inhabiting the main stream, were almost fully developed, being numerous and of a large size, whilst there were a considerable number of fry in the side streams of the Ravi.

Colours. Greyish, becoming white below, pre-opercle dashed with golden; lower fins tinged red. After death two or three rows of dark grey blotches appear above the lateral line. Some have scattered black and occasionally red spots, and these have been termed *Trout*.

Hab. Afghanistan, Himalayas and in all the rivers of the Punjáb. It adheres to rocks by means of its sucker and is thus enabled to reside in mountain rapids. It is also found in Cashmere, Darjeeling and apparently in Bútán. It attains 2 feet in length, is pretty good eating but bony; it is too rich for some people, but does not affect those used to it.

I have received some specimens from near Darjeeling, through Dr. Stoliczka; these I found to agree very well with McClelland's figure of *O. guttatus*, except in one or two less number of dorsal rays. Having since examined numerous specimens from the Ravi, its tributaries and other Punjáb rivers, I find them identical with the Darjeeling species.

3. OREINUS PLAGIOSTOMUS.

Schizothorax plagiostomus, Heckel, Fische aus Caschmir, p. 16, t. 1; \*Cuv., and Val., xvi, p. 213.

Oreinus plagiostomus, McClelland, Cal. Journ. Nat. Hist. ii, 1842, pp. 570, 581; Günther, Catal. vii, p. 160.

B. III. D. 3/8, P. 17, V. 11, A. 3/5, C. 19.

Length of head 2/9, of caudal 2/9, height of body 1/4 of the total length.

Eyes. Diameter 1/6 of length of head, 2 diameters from end of snout.

Snout broad, interorbital space nearly flat; mouth transverse, inferior, lower lip with a free posterior margin, and having a considerable number of glands on its surface.

Fins. Dorsal osseous ray of moderate strength, its stiff portion as long as the head without the snout, its serrature being rather feeble; the fin commences somewhat in advance of the ventrals, and midway between the end of the snout, and the root of the caudal; anal narrow but its rays rather long, the scales along its base well developed, the largest being nearly the size of the orbit.

Colours.—uniform silvery.

Hab. Afghanistan and Cashmere. Heckel's specimen, by the figure, appears to have had pores on the snout and a shorter anal.

O. Griffithii, McClelland, l. c. p. 581, is said to differ but little from the above, its intestines are six times the length of the body, its *habitat* is Afghanistan, Koonur river, Pushut.

4. OREINUS RICHARDSONII.

Cyprinus Richardsonii, Gray and Hard., Ill. Ind. Zool.

Gonorrhynchus petrophilus, McClell., Journal As. Soc. of Bengal, iv, p. 39, c. fig.; \*Cuv. and Val., xvi, p. 466.

Oreinus maculatus, \*Cuv. and Val., xvi, p. 228; Günther, Proc. Zool. Soc. 1861, p. 224.

Oreinus Richardsonii, McClell., Ind. Cyp. pp. 273, 345; \*Cuv. and Val. xvi. p. 227; Günther, Catal. vii, p. 162.

Asla, Nipál.

B. III. D. $\frac{3}{8}$, P. 15, V. 10, A. $\frac{3}{5}$, C. 19, L. 1. ca. 140.

Length of head $\frac{1}{7}$, of caudal $\frac{2}{11}$, height of body $\frac{2}{11}$ of the total length.

Eyes. Diameter from $\frac{2}{9}$ (in young) to $\frac{1}{6}$ of length of head, 2 diameters from end of snout.

Interorbital space slightly convex, and broad. Mouth broad, margin of lower lip straight. Barbels small.

Fins. Osseous dorsal ray strong, its stiff portion being as long as the head without the snout, it commences midway between the end of the snout and the root of the caudal, and slightly in advance of the ventrals. Anal rays long, the scales on the sheath nearly as large as the orbits.

Colour.—uniform silvery.

Hab. Nipál specimens 18 inches long exist in the British Museum.

Genus, SCHIZOPYGOPSIS, *Steind.* Pl. xxii, fig. 5, (from Steind.)

Abdomen rounded. Snout obtusely conical. Mouth transverse, inferior, with a slight cleft; mandible with a sharp anterior edge, having a horny covering, and the upper lip continuous with a short lateral one. Barbels absent. Pharyngeal teeth compressed, 4 or 3, 3/3, 3 or 4. Dorsal fin short, with a serrated ray, and situated nearly opposite to the ventrals; anal short. Scales small, few, and only present in the scapular region. A scaled sheath to vent and anal fin. Lateral line continued to the centre of the base of the caudal.

Geographical distribution.—Tibet.

Only one species known.

1. *Schizopygopsis Stoliczkæ*, D. 4/7, A 2/5. Tibet.

1. SCHIZOPYGOPSIS STOLICZKÆ.

Steind., Verh. Zool.-bot. Ges. Wien, 1866, p. 785; Günther, Catal. vii, p. 170.

B. III. D. 4/7, P. 13, V. 9, A. 2/5, C. 19.

Fins. Dorsal arises midway between the end of the snout and the root of the caudal, its last half being posterior to the ventrals.

Colours. Olive, with irregular blackish specks.

Hab. Stream near the monastery of Hanlé, Eastern Ladak, at about 15,200 feet elevation, where it was obtained by Dr. Stoliczka.

Genus, DIPTYCHUS, Stein. Pl. xxiii, fig. 1, 2.

Abdomen rounded; snout obtuse; mouth inferior, transverse, curved; lower jaw sharp, with an internal horny covering; lips continuous and having an uninterrupted labial fold across the mandible. Two maxillary barbels. Gill opening narrow. Pharyngeal teeth compressed 4, 3/3, 4. Dorsal fin without osseous ray, commencing opposite the ventrals; anal short; caudal forked. Scales small, only on the sides of the body and tail, also a scaly sheath to the vent and base of the anal fin. Lateral line continued to the centre of the base of the caudal.

Geographical distribution.—Tibet and Nipál.

Only one species known.

1. *Diptychus maculatus*, D. 3/8, A. 2/5. Tibet and Nipál.

1. DIPTYCHUS MACULATUS. Pl. xxiii, fig. 1, 2.

Steind., Verh. Zool.-bot. Ges. Wien., 1866, p. 788, t. 13, fig. 5; Günther, Catal. vii, p. 171.

B. III. D. $3/8$, P. 15, V. 9, A. $2/5$, C. 19.

Length of head $1/5$, of caudal $2/9$, height of body $2/9$ of the total length.

Eyes. Diameter $2/9$ of length of head, $1\frac{1}{3}$ diameters from end of snout, $1\frac{1}{2}$ apart.

Barbels scarcely as long as the eye.

Fins. Dorsal anterior to the ventral, its last ray being above it, whilst it commences slightly nearer snout than root of caudal.

Colours,—bluish, lightest inferiorly, indistinctly blotched and spotted, dorsal and caudal fins also spotted. Some specimens have longitudinal streaks.

Hab. Near Lei in Ladak, about 12,000 feet above the sea, also near Puga and Khorzok in Rupshu, at 14,000 to 15,500 feet, where it was obtained by Dr. Stoliczka; Nipál. It attains 5 or 6 inches in length.

\*Genus, PTYCHOBARBUS, Steind. Pl. xxiii, f. 3, (from Steind.)

Abdomen rounded, snout conical, mouth arched, inferior. Two maxillary barbels. Pharyngeal teeth compressed 4, 3/3, 4. A deep groove exists along the back, from the dorsal to the caudal fin. Dorsal fin without osseous ray, situated opposite the ventrals; anal short. Scales small, covering the body, and forming a sheath at the base of the vent and anal fin. Lateral line continued to the centre of the base of the caudal.

Geographical distribution.—Tibet.

Only one species known.

1.\* *Ptychobarbus conirostris*, D. 11, A. 8. Tibet.

1.\* PTYCHOBARBUS CONIROSTRIS, Pl. xxiii, f. 3, (from Steind.)

Steind., Verh. Zool.-bot. Ges. Wien. 1866, p. 789, t. 17, f. 4; \*Günther, Catal. vii, p. 169.

B. III. D. 11, V. 10, A. 8, L. 1. 100.

Length of head about $1/4$ ($6/25$), height of body $1/6$ of the total length.

Eyes. Diameter $1/4$ to $1/5$ of length of head, $1\frac{1}{2}$ diameters from end of snout.

Maxillary barbels as long as the orbit.

Fins. Dorsal commencing nearer end of snout than root of the caudal, its anterior half being before the root of the ventrals.

Colours. Body and fins with many minute and irregularly disposed blackish spots.

Hab. Stream near Hanlé Monastery in Eastern Ladak, Tibet, where (at about 15,200 feet) it was obtained by Dr. Stoliczka.

b. Dorsal fin commencing very distinctly posterior to the ventrals, but not extending to above the anal, which last is short or of moderate length (5 to 10 branched rays).

Genus NURIA, Cuv. and Val. Pl. xxiii, f. 6.

ESOMUS Swainson.

Abdomen rounded. Pseudobranchiæ present, mouth narrow, directed obliquely upwards, suborbitals broad. Barbels four, the rostral shorter than the maxillary pair; pharyngeal teeth crooked, pointed, 5/5. Dorsal fin without osseous ray, and a few branched ones, it is inserted posterior to the ventral but not to over the anal, the latter having but few or a moderate number of branched rays; scales of moderate size. Lateral line, when present, passing to the lower half of the base of the caudal fin. Gill rakers short.

Geographical distribution. Continent of India, Ceylon and Burma.

Synopsis of species.

1. *Nuria albolineata*, D. 2/7, A. 2/11, L. 1. 31. Burma.
2. *Nuria danrica*, D. 2/6, A. 3/5, L. 1. 30-34. Lateral line present. A black lateral band. India, Ceylon and Burma.
3. *Nuria Malabarica*, D. 2/7, A. 2/5, L. r. 32. Lateral line absent. No black lateral band. India, Burma, and Nicobars.

1. NURIA ALBOLINEATA.

Blyth, J. A. S. of B. 1860, p. 163; Day. Proc. Zool. Soc. 1869, p. 558.

B. III. D. 2/7, P. 11, V. 7, A. 2/11, C. 17, L. 1. 31.

Length of head 2/9, of caudal 1/5, height of body 2/7 of total length. Eyes 3/4 of a diameter from end of snout. Maxillary barbels reach the ventral fin. Lateral line ceases above ventral fin. Colours; a silvery band along the side. *Habitat.* Moulmein.

2. NURIA DANRICA. Pl. xxiii, f. 6.

Cyprinus danrica, sutiha et jogia, Ham. Buch., Fish. Ganges, pp. 325, 327, 390, 391. pl. 16, f. 88; \* Cuv. and Val., xvi, pp. 404, 405, 408.

Perilampus recurvirostris, McClell., Ind. Cyp. pp. 290, 398, pl. 46, f. 2, (from H. B.'s. MS.)

„ *macrourus*, et *thermophilus*, McClell., l. c. pp. 291, 398, 399, pl. 46, f. 3.

Nuria thermoicos, et *thermophilus*, Cuv. and Val., xvi, pp. 238, 240, p. 472.

Leuciscus barbatus, Jerdon, M. J. L. and S. 1849, p. 322.

Nuria danrica, Bleeker, Verh. Bat. Gen. xxv. Beng. and Hind. p. 130; Günther, Catal. vii, p. 200; Day, Proc. Zool. Soc. 1869, p. 558.

„ *alta*, Blyth, J. A. S. of B. 1860, p. 162.

Esomus danrica, Bleeker, Atl. Ich. Cypr. p. 32, (No description.)

„ *thermoicos*, Kner, Novara Fische, p. 363.

„ *Maderaspatensis*, Day, Proc. Zool. Soc. 1867, p. 300.

Danrica and *Jongja*, Beng.; *Kurriah dahwiee*, Hind., *Soomarah*, Hind., (N. W. P.)

B. III. D. 2/6, P. 15, V. 9, A. 3/5, L. 1. 30-34, L. tr. 5-6/3.

Length of head 2/11, of caudal 1/5, height of body 1/4 of the total length.

Eyes. Diameter 2/7 of length of head, 1 diameter from end of snout and apart.

Rostral barbels not so long as the head, the maxillary ones extend to the base of the ventral or even to that of the caudal.

Fins. Pectoral varies with age, being generally proportionately longer in the immature.

Lateral line—present, entire.

Colours. A broad black lateral band, sometimes absent.

Hab. India, Ceylon and Burma. Dr. Cumberland found it in a hot stream of 112° Fahr. at Pooree; it attains 5-inches in length.

3. *NURIA MALABARICA.*

Esomus Malabaricus, Day, Proc. Zool. Soc., 1867, p. 299; 1869, p. 559.

B. III. D. 2/7, P. 12, V. 9, A. 2/5, C. 19, L. r. 32, L. tr. 7.

Length of head 2/11, of caudal 2/9, height of body 1/4 of the total length.

Eyes. Diameter 2/7 of length of head, 1 diameter from end of snout, 1½ diameters apart.

Cleft of mouth not extending half way to the orbit; rostral barbels reach to the middle of the orbit, the maxillary to the base of the ventral fin.

Fins. Dorsal commences midway between the anterior margin of the orbit and the posterior extremity of the caudal fin. Pectorals reach the base of the ventrals. Caudal deeply lunate.

Teeth, pharyngeal—crooked, pointed 5/5.

Lateral line,—entirely absent.

Colours—uniform, with a silvery lateral band, which has occasionally a very narrow superior black border.

Hab. India, Burma, and the Nicobars; attaining 3 inches in length.

Genus, *RASBORA*, *Bleeker*. Pl. xxiii, f. 5.

LEUCISCUS, sp. *Cuv. and Val.*

Abdomen rounded. Pseudobranchiæ present. Cleft of mouth oblique, lower jaw slightly prominent, having one central and a lateral prominence on either side, fitting into corresponding emarginations in the upper jaw. Barbels two (rostral), or none. Eyes with free lids. Pharyngeal teeth 5, 3 or 4, 2/2, 3 or 4, 5. Dorsal fin without osseous ray and few branched ones, inserted posterior to the origin of the ventral but not extending to above the anal, which latter is short. Scales large, or of moderate size. Lateral line concave, continued to the lower half of the caudal fin. Gill rakers short and lanceolate.

Geographical distribution. India, Ceylon and Burma.

SYNOPSIS OF SPECIES.

A. *Barbels present, (Megarasbora).*

1. *Rasbora elanga*, D. 2/7, A. $\frac{2}{5-6}$, L. 1. 40—42. Bengal, Assam and Burma.

B. *Barbels absent (Rasbora).*

2. *Rasbora daniconius*, D. 2/7, A. $\frac{2-3}{5}$, L. 1. 30—32. A black lateral stripe. Continent of India and Ceylon.
3. „ *Neilgherriensis*, D. 2/7, A. 2/5, L. 1. 34. A light lateral band. Neilgherry hills.
4. „ *Buchanani*, D. 2/7, A. 2/5, L. 1. 25-26. No lateral band. From Mysore throughout India, Assam and Burma.

A. *Barbels present (Megarasbora).*

1. *RASBORA (Megarasbora) ELANGA.*

Cyprinus elanga, Ham. Buch., Fish. Ganges, p. 281; \**Cuv. and Val.*, xvi, p. 415.

Leuciscus dystomus, McClell., Ind. Cyp. pp. 292, 406, pl. 56, f. 4.

Rasbora elanga, Günther, Catal. vii, p. 198.

Dakwiee, Hind.

B. III. D. $2/7$, P. 15, V. 8-9, A. $\frac{2}{5-6}$, C. 19, L. 1. 40—42, L. tr. $7/6$.

Length of head $1/5$, of caudal $1/6$, height of body $2/9$, of dorsal fin $1/5$ of the total length.

Eyes. Diameter from $1/4$ to $1/3$ of the length of head, 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart.

Head pointed, jaws of equal length, prominences and emarginations well defined. One pair of short rostral barbels.

Fins. Dorsal commences midway between the posterior margin of the orbit and the base of the caudal fin. The pectoral does not reach the ventral. Caudal forked.

Lateral line. Two rows of scales to base of ventral fin.

Colours. Silvery.

Hab. Bengal, Assam and Burma; attaining 8 inches in length.

B. *Barbels absent (Rasbora, as restricted).*

2. *RASBORA DANICONIUS.*

Cyprinus daniconius, Ham. Buch., Fish. Ganges, pp. 327, 391, pl. 15, f. 89; \*Cuv. and Val. xvi, p. 435.

„ *anjana*, Ham. Buch., l. c. pp. 329, 391: \*Cuv. and Val., xvi, p. 436.

Leuciscus anjana, *daniconius*, *rasbora*, et *lateralis*, McClell., Ind. Cyp. pp. 292, 405, 407.

„ *dandia*, Cuv. and Val., xvii, p. 309.

„ *Malabaricus*, *Caverii* et *flavus*, Jerdon, M. J. L. and S. 1849, pp. 320, 321.

„ *Einthovenii*, Bleeker, Nat. Tyd. Ned. Ind. ii, p. 434.

Rasbora Einthovenii, Bleeker, Prod. Cyp. p. 440, and Atl. Ich. Cyp. p. 120, t. 21, f. 1.

„ *dandia*, Bleeker, Nat. Verh. Holl. Maatsh. Haarl. 1864, Cyp. and Cobit., Ceylon, p. 18, pl. 1, f. 3.

„ *Malabarica*, Day, Mal. Fish. p. 220.

„ *woolaree*, Day, Proc. Zool. Soc. 1867, p. 298.

Opsarius daniconius, Kner, Novara Fische, p. 358.

Rasbora daniconius, Günther, Catal. vii, p. 194.

? *Chondrostoma wattanah*, Sykes, T. Z. S. ii, p. 360, pl. 62, f. 4.

? *Gymnostomus wattanah*, \*Günther, l. c. vii, p. 76.

Kokanutchee, Mal. ; *Jilo*, Ooriah, *Danikoni* and *Angjani*, Beng.

B. III. D. 2/7, P. 15, V. 9, A. $\frac{2-3}{5}$, C. 19, L. l. 30-32, Vert. 18/14.

Length of head $\frac{1}{4}$ to $\frac{1}{5}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{4}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, 1 diameter from end of snout and apart.

Prominences and emarginations on jaws well defined. Cleft of mouth extends to beneath anterior margin of orbit.

Teeth, pharyngeal—curved, sharp 5, 3, 2/2, 3, 5.

Fins. Dorsal commences midway between snout and base of caudal, which latter is forked.

Lateral line—at first concave, 2 rows of scales between it and ventral fin.

Colours. A black band, more or less distinct, passes from the eye to the base of the caudal. Sometimes, more especially in Burma, each caudal lobe is tipped with black.

Hab. Continent of India, Ceylon, Burma, and Malay archipelago, attaining 5 inches in length.

3. *RASBORA NEILGHERRIENSIS*. Pl. xxiii, f. 5.

Rasbora Neilgherriensis, Day, Proc. Zool. Soc. 1867, p. 298; Günther, Catal. vii, p. 197.

Ovaree candee, Tam.

B. III. D. 2/7, P. 13, V. 9, A. $\frac{2}{5}$, C. 19, L. l. 34, L. tr. $6\frac{1}{2}/5$.

Length of head $\frac{2}{11}$, of caudal $\frac{2}{11}$, height of body $\frac{1}{5}$ of the total length.

Eyes. Diameter $\frac{1}{5}$ of length of head, $1\frac{1}{4}$ diameters from end of snout and apart.

Cleft of mouth extends to nearly beneath the anterior margin of the orbit. Prominences on sides of jaw scarcely apparent.

Teeth, pharyngeal—5, 3, 2/2, 3, 5.

Fins. Dorsal commences nearer the snout than the base of the caudal, which latter is slightly lobed.

Lateral line,—2 rows of scales between it and the ventral fin.

Colours. A silvery-leadен band from the eye to the base of the caudal.

Hab. Rivers on and around the Neilgherry Hills, attaining 8 inches in length.

4. RASBORA BUCHANANI.

Cyprinus rasbora, Ham. Buch., pp. 329, 391, pl. 2, f. 90 ; \*Cuv. and Val., xvi, p. 438.

Leuciscus rasbora, McClell., Ind. Cyp. pp. 292, 407 ; Cantor, Catal. p. 268 ; Bleeker, Verh. Bat. Gen. xxv, Beng. and Hind. p. 140.

Leuciscus presbyter, Cuv. and Val., xvii, p. 307.

Rasbora Buchanani, Bleeker, Prod. Cyp. p. 451, and Atl. Ich. Cyp. p. 125, pl. 14, f. 3 ; Günther, Catal. vii, p. 196.

Leuciscus xanthogramme et microcephalus, Jerdon, M. J. L. and S. 1849, p. 321.

B. III. D. 2/7, P. 15, V. 9, A. 2/5, C. 19, L. 1. 26—29.

Length of head 1/5, of caudal 1/5, height of dorsal 1/6 of the total length.

Eyes. Diameter 2/7 of length of head, 1 diameter from end of snout, and rather more apart.

Posterior extremity of maxilla extends to under the anterior margin of the orbit. Prominences on jaws well developed.

Fins. Dorsal commences slightly nearer snout than base of caudal.

Lateral line—ceases about 2 scales anterior to the base of the caudal.

Colours,—silvery, a faint streak along the side, caudal usually tipped with black.

Hab. Continent of India, Assam, Burma and Pinang ; attaining 4 or 5 inches in length.

Genus—*ASPIDOPARIA* (Heckel) Bleeker. Pl. xxiii, f. 4.

Morara, Bleeker.

Abdomen rounded. Mouth small, inferior, the lower jaw having a sharp crescentic edge destitute of lip. Barbels absent. Suborbital ring of bones of moderate width or broad. Pharyngeal teeth, 4, 4, 2/2, 4, 4. Dorsal fin without osseous and with rather few branched rays, commencing opposite to or behind the origin of the ventrals, but not extending to above the anal, which latter has a moderate number (10 to 12) of rays. Scales of moderate size. Lateral line concave, and passing along the lower half of the base of the caudal fin.

Geographical distribution. Throughout Bengal, Assam, Bombay and Orissa as far as the Kistna river, and also in Burma.

SYNOPSIS OF SPECIES.

1. *Aspidoparia morar*, D. $\frac{2-3}{7-8}$, A. $\frac{2}{9-10}$, L. 1 33—42. *India generally, except the western coast and south of Kistna; Burma and Assam.*
2. „ *jaya*, D. 2/10, A. 2/8, L. 1. 58. *N. W. Provinces and Assam.*

1. ASPIDOPARIA MORAR. Pl. xxiii, f. 4.

Cyprinus morar, Ham. Buch., pp. 264, 384, pl. 31, f. 5; Gray and Hard., Ill. Ind. Zool. (from H. Buch.); \*Cuv. and Val., xvi, p. 459.

Leuciscus morar, McClell., Ind. Cyp., pp. 294, 410; Sykes, P. Z. Soc. 1841, p. 363; Bleeker, Verh. Bat. Gen., xxv, Beng. and Hind. p. 136; \*Jerdon, M. J. L. and S., 1849, p. 323.

Morara morar, Bleeker, Prod. Cyp. p. 115.

Aspidoparia sardina, Heckel, Russ. Reis. ii, 3, p. 288; Günther, Catal. vii, p. 285.

Aspidoparia (?) *morar*, \*Günther, Catal. vii, p. 285.

Bayi, Oorlah; *Morari* and *Morar* Beng.; *Nga-hpyen-boo* and *Yen-boung-za*, Burmese; *Amlee*, Deck.; *Chippuah*, *Chelluah*, Hind. (N. W. P.).

B. III. D. $\frac{2-3}{7-8}$, P. 15, V. 8, A. $\frac{2}{9-10}$, C. 19, L. 1. 38—42, L. tr. $5\frac{1}{2}/5$, Vert. 14/21.

Length of head $\frac{2}{9}$, of caudal $\frac{2}{9}$, height of body $\frac{1}{4}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, $\frac{3}{4}$ of a diameter from end of snout and apart.

The cheek is covered by a broad suborbital ring of bones.

Fins. Dorsal higher than long, with a concave superior margin; it arises midway between the posterior margin of the orbit and the base of the caudal; pectoral as long as the head.

Lateral line;— $2\frac{1}{2}$ rows of scales between it and the base of the ventral fin.

Colours—silvery.

Hab. Continent of India (except the western coast, and places south of the Kistna river), also Assam and Burma. It attains 6 inches or even more in length. In one specimen, captured in Orissa, the anal fin was entirely absent.

2. *ASPIDOPARIA JAYA.*

Cyprinus jaya, Ham. Buch., Fish. Ganges, pp. 333, 392; \*Cuv. and Val., xvi, p. 439.

Leuciscus margarodes, McClell., Ind. Cyp. pp. 294, 411.

Aspidoparia jaya, \*Günther, Catal. vii, p. 286.

Chola, Assam; *Pakruah*, Hind. (N. W. P.).

B. III. D. 2/10, P. 15, V. 8, A. 2/8, C. 21, L. 1. 58, L. tr. 7/10.

Length of head nearly 1/5, of caudal 1/5, height of body 1/5 of the total length.

Eyes. Diameter 2/7 of length of head, 1 diameter from end of snout, 1½ diameters apart.

Mouth generic, considerably overhung by the snout. Both the preorbital and second suborbital bones touch the upper lip; scarcely above half the cheek is covered by the suborbital ring of bones.

Fins. Dorsal commences nearer to the snout than to the base of the caudal, and above the ventral. Caudal lobes of equal length.

Scales—deciduous.

Lateral line—curving at its termination on to the lower half of the caudal fin.

Colour—silvery, back darkest.

Hab. Hurdwar on the Ganges and Assam. *Perilampus elingulatus*, McClelland, is probably this species, it is said to have come from Simla? and to have D. 9, A. 10, L. 1. 46.

C. *Dorsal fin commencing in the interspace between the ventrals and anal, generally extending to over the latter, which is of moderate length or elongated (7 to 33 branched rays).*

Genus—*ROHTEE*, Sykes. Pl. xxiii, f. 7.

Osteobrama, Heckel.

? *Smiliogaster*, Bleeker.

Abdomen rounded. Pseudobranchiæ present. Mouth anterior, lips thin. Barbels absent. Pharyngeal teeth, 6 or 5 or 4, 4 or 3, 2 or 3/3 or 2, 3 or 4, 4 or 5 or 6. Dorsal fin short, having an osseous serrated spine, and commencing opposite the interspace between the bases of the

ventral and anal fins, the latter of which has many rays. Scales small. Lateral line passing nearly to the centre of the base of the caudal fin. Gill rakers short.

Geographical distribution. Continent of India, north of the Kistna river, also in Burma.

SYNOPSIS OF SPECIES.

1. *Rohtee cotio*, D. $\frac{3-4}{8}$, A. $\frac{3}{26-29}$, L. l. 71, L. tr. 17/21. India including the Punjab.
2. „ *Alfrediana*, D. $\frac{2-3}{8}$, A. $\frac{2-3}{29-33}$, L. l. 42—60. L. tr. $\frac{8-10}{14-17}$, Throughout Burma, Assam, Bengal and extending to the Tamboodra and Kistna rivers.
3. „ *Vigorsii*, D. $\frac{3}{8}$, A. $\frac{3}{22-23}$, L. l. 75, L. tr. $\frac{18}{19}$, Deccan and throughout Kistna river.
4. „ *microlepis*, D. $\frac{3-4}{8}$, A. $\frac{3}{18}$, L. l. 71—73. Godavery and Burma.
5. „ *Ogilbii*, D. $\frac{3}{8}$, A. $\frac{3}{13}$, L. l. 55, L. tr. 13/11. Central India.

1. ROHTEE COTIO, pl. xxiii, f. 7.

Cyprinus cotio, Ham. Buch., Fish. Ganges, pp. 339, 393, pl. 39, f. 93; \*Cuv. and Val., xvii, p. 76.

Abramis cotis, McClell., Ind. Cyp. pp. 288, 388.

Osteobrama cotis, \*Heckel, in Russ. Reis. i, p. 1033.

„ *cotio*, Günther, Catal. vii, p. 323.

Koti, Beng.; *Goordah*, Hind. (N. W. P.); *Puttoo*, Punj.

B. III. D. $\frac{3-4}{8}$, P. 13, V. 10, A. $\frac{3}{26-29}$, C. 19, L. l. 71, L. tr. 15-17/21.

Length of head $\frac{1}{6}$, of caudal $\frac{1}{5}$, height of body about $\frac{1}{3}$ of the total length.

Eyes. Diameter nearly $\frac{1}{3}$ of the length of head, nearly 1 diameter from end of snout. Profile over the nape concave. Jaws, even in front when the mouth is closed.

Fins. Osseous dorsal ray weak and serrated; lower caudal lobe the longer.

Scales—about twelve rows between the lateral line and base of ventral fin, whilst they are undulating and rather irregular.

Colours. Silvery.

2. ROHTEE ALFREDIANA.

Leuciscus Duvaucelii, Cuv. and Val., xvii, p. 77.

„ *Alfredianus*, Cuv. and Val., xvii, p. xvi, (index) pl. 488.

Osteobrama cotis, Blyth, J. A. S. of Bengal, 1860, p. 158.

Osteobrama Alfredianus, Günther, Catal. vii, p. 324.

Goonta, Beng.

B. III. D. $\frac{2-3}{8}$, P. 13, V. 10, A. $\frac{2-3}{29-33}$, C. 19, L. 1. 42-60,

L. tr. $\frac{8-10}{14-17}$.

The following specimens are amongst those collected by myself.

D. 2/8, A. 2/29, L. 1. 48, L. tr. 10/16 from Pegu.

D. 2/8, A. 2/33, L. 1. 50, L. tr. 12/16, „ Balasore.

D. 3/8, A. 2/29, L. 1. 56, L. tr. 10/16, „ „

D. 2/8, A. 2/33, L. 1. 60, L. tr. 12/17, „ „

D. 2/8, A. 2/30, L. 1. 45, L. tr. 8/14, „ Rangoon.

D. 3/8, A. 2/30, L. 1. 51, L. tr. 9/? „ Mandalay.

D. 3/8, A. 2/29, L. 1. 42, L. tr. 9/14, „ Moulmein.

D. 3/8, A. 3/29, L. 1. 51, L. tr. 10/14, „ „

Length of head $\frac{1}{6}$, of pectoral $\frac{2}{13}$, of caudal $\frac{1}{5}$, height of body $\frac{4}{13}$ of the total length.

Eyes. Diameter $\frac{2}{5}$ of length of head, $\frac{1}{2}$ diameter from end of snout, 1 diameter apart.

Profile over nape concave, from thence a great rise to the base of the dorsal fin. Upper jaw slightly the longest, snout very obtuse and elevated over the nostrils.

Fins. Dorsal commences midway between the snout and the base of the caudal, its osseous ray weak and serrated. Caudal deeply lobed, the lower the longest.

Lateral line,—very strongly marked in the first few scales, the rows below the lateral line regular and horizontal.

Colour. Silvery.

Hab. Orissa, Bengal, Assam and Burma, attaining 6 inches or more in length.

3. ROHTEE VIGORSII.

Sykes, Trans. Zool. Soc. 1841, p. 36, pl. 63, f. 3; Day, Proc. Zool. Soc. 1869, p. 379.

Osteobrama rapax, Günther, Catal. vii, p. 323.

Gollund, Ooriah; *Khira*, Tel.

B. III. D. $\frac{3}{8}$, P. 19, V. 10, A. $\frac{3}{22-23}$, C. 19, L. 1. 75, L. tr. $\frac{18}{19}$.

Length of head $\frac{1}{5}$, of pectoral $\frac{1}{7}$, of caudal $\frac{1}{4}$, height of body $\frac{1}{3}$, of dorsal fin $\frac{1}{6}$ of the total length.

Eyes. Diameter $\frac{1}{3}$ of length of head, 1 diameter from end of snout and apart.

Dorsal profile elevated, a slight concavity from the snout to over the nape. Mouth anterior, the lower jaw being somewhat longer than the upper, whilst posteriorly the cleft of the mouth extends to below the anterior margin of the orbit. Preorbital nearly as high as broad, suborbitals very narrow.

Teeth, pharyngeal—crooked, 5, 4, $2\frac{1}{2}$, 4, 5.

Gill rakers short and rather widely separated.

Fins. Dorsal commences midway between the base of the ventral and anal, its spine strong and deeply denticulated, its osseous portion not so long as the head. Caudal deeply forked.

Lateral line—most strongly developed in the first few scales. The largest scales are near the lateral line.

Colours. Greenish superiorly, silvery beneath. The caudal fin slightly stained with grey.

Hab. Deccan and Kistna river to its termination; it attains eight inches in length.

4. ROHTEE MICROLEPIS.

? *Leuciscus Belangeri*, Cuv. and Val., xvii, p. 99.

Systemus microlepis, Blyth, J. A. S. of Bengal, 1858, p. 289, and 1860, p. 158.

Rohtee Blythii, \*Bleeker, Prod. Cyp. p. 281.

? *Smiliogaster Belangeri*, \*Bleeker, Atl. Ich. Cyp. p. 33; \*Günther, Catal. vii, p. 328.

Osteobrama microlepis, \*Günther, Catal. vii, p. 325.

B. III. D. $\frac{3-4}{8}$, P. 17, V. 9, A. $\frac{3}{18}$, C. 17, L. 1. 71-73, L. tr. $\frac{18}{22}$.

Length of head $2/11$, of caudal $1/4$, height of body $1/3$ of the total length.

Eyes. Diameter $1/3$ of length of head, $3/4$ of a diameter from end of snout, $1\frac{1}{2}$ diameters apart.

Lower jaw slightly the shorter. Dorsal profile much elevated, a slight concavity over the nape. Preorbital of moderate width, the rest of the suborbital ring narrow.

Teeth, pharyngeal—4, 3, $2/2$, 3, 4, serrated on their edges, the two largest of the anterior row molarform.

Gill rakers rudimentary.

Fins. Dorsal commences slightly nearer the base of the caudal than the end of the snout, its osseous ray is strong and serrated in its upper two-thirds, the bony portion being as long as the head. Caudal deeply lobed, the lower slightly the longest.

Colours. Silvery, back greyish, and the Indian variety is partially banded, more especially in the young. A dark streak from the shoulder to the base of the pectoral fin.

Hab. The Godavery river, and throughout Burma, but the specimens from the latter locality are darker in colour and want the vertical bands. It attains 15 inches and more in length. Although Valenciennes who described *Leuciscus Belangeri*, and Bleeker and Günther, who have not seen it, have considered this species the type of a genus (*Smiliogaster*), which is said to have a compressed abdomen, "mais sans aucune dentelure, comme celles des clupées" it appears to me most probable that the typical specimens were badly preserved ones of *Rohtee microlepis*.

5. ROHTEE OGILBII.

Sykes, Trans. Zool. Soc. 1841, p. 64, pl. 63, f. 2.

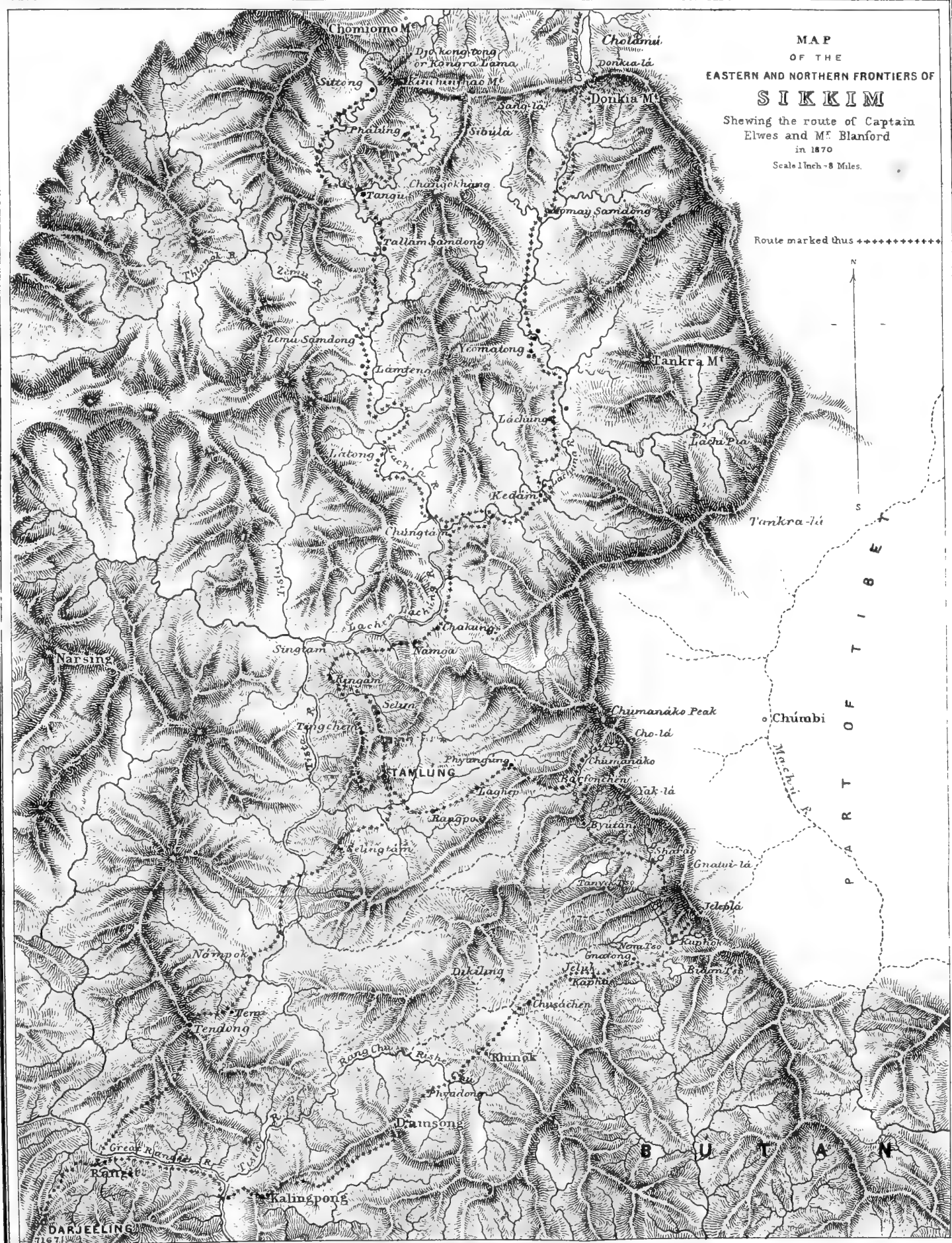
Osteobrama Ogilbii, Heckel, in Russ. Reis. i. p. 1033; Günther, Catal. vii, p. 324

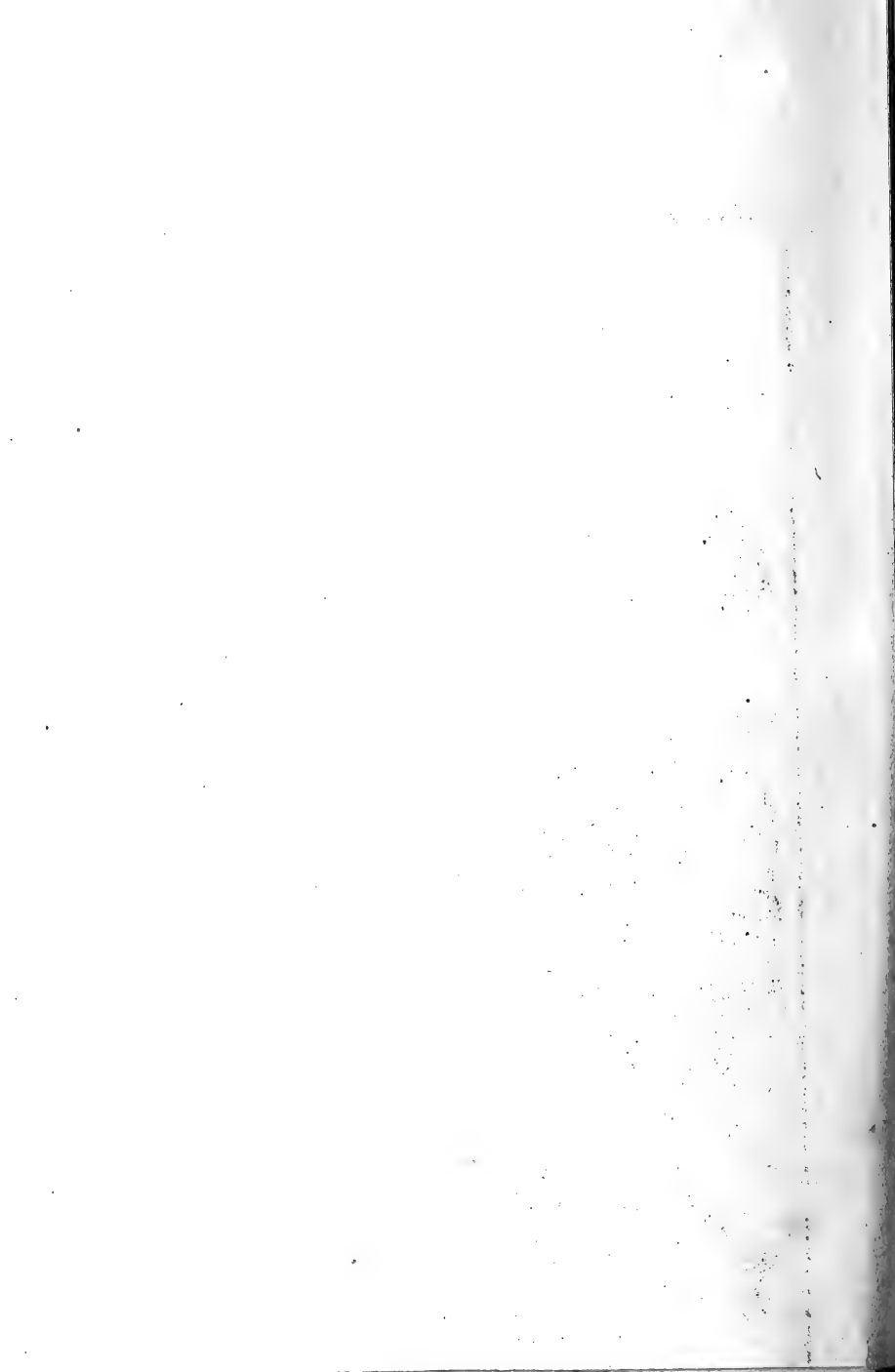
B. III. D. $3/8$, P. 15, V. 10, A. $3/13$, C. 20, L. l. 55, L. tr. $13/11$.

Length of head $1/7$, of pectoral $1/7$, of caudal $1/4$, height of body $1/3$, of dorsal fin $1/4$ of the total length.

Eyes. Diameter nearly $1/2$ of length of head, $1/2$ a diameter from end of snout, above 1 diameter apart.

Dorsal and abdominal profiles about equally convex. Cleft of





mouth extending to below the anterior third of the orbit, lower jaw shortest.

Teeth, pharyngeal,—pointed, 5, 4, 2/2, 4, 5.

Fins. Dorsal commences midway between the snout and the base of the caudal, its osseous ray strong, and coarsely serrated. Caudal lobed in its last two-thirds.

Colours. Purplish silvery along the back, becoming silvery white from about four rows of scales above the lateral line.

Hab. Central India, attaining 6 inches or more in length.

(*To be continued.*)



ACCOUNT OF A VISIT TO THE EASTERN AND NORTHERN FRONTIERS OF
INDEPENDENT SIKKIM, WITH NOTES ON THE ZOOLOGY OF THE
ALPINE AND SUBALPINE REGIONS, Part I,\*—by WILLIAM T. BLAN-
FORD, F. G. S. ; C. M. Z. S. &c.

(With a map, plate XXIV.)

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The extent to which the interior of Sikkim has been neglected by Anglo-Indians is very remarkable. It is true that the country does not present attractions in the way of sport, and this alone is the inducement which takes nine-tenths of our countrymen into the Alpine regions of the Western Himalayas. It is true also that there are no roads, that the tracks along which it is necessary to climb are frequently such as require the use of one's hands as well as legs, that but few supplies are procurable, and that everything must be carried on coolies, who must be taken from British territory; it is also true that the discomforts arising from frequent rain, and the attacks of leeches and insects are, during part of the year, a great drawback to travelling; still it is a curious fact that since Drs. Hooker and Campbell first explored the country in 1848-49, but one European had penetrated to the passes of Donkia and Kongra Lama before the visit I am about to describe, although the country has been open to travellers during at least half the in-

\* This part contains the description of the journey, the second part will consist of notes on the fauna, especially on the birds.

tervening period. Captain Chamer, the solitary visitor who reached the Northern passes, made a rapid journey in search of sport in the spring of 1870, but was not very successful.\*

It had for a long time appeared to me that the fauna of the alpine portion of Sikkim was far less known than that of most other accessible regions of the Himalaya. Much novelty, amongst the vertebrata at least, was not to be expected, because Mr. Hodgson's collectors had ransacked for years the neighbouring regions of Nipál. But still no one, except Dr. Hooker, had ever observed the animals of the country, and the attention of that veteran Himalayan traveller was mainly devoted to the botany, although numerous notes on the fauna are scattered through his delightful "Himalayan Journals." I believe that the popularity of that model naturalist's note book has rather tended to prevent further exploration of the country. Few people can conceive how very little is really known of the fauna of upper Sikkim, despite the number of years that have elapsed since its leading features were first described, or that the animals of the upper Láchen and Lá-chúng valleys are no better known than those of the Pangong lake and Ladák.

The vertebrate fauna of British Sikkim, one of the richest, if not the very richest in the whole world, has been pretty completely explored by Hodgson, Tickell, Jerdon, Beavan and others, but not one of these observers penetrated to the snows. The only travels in Sikkim since the time of Hooker and Campbell, of which accounts have been published, are those of Captain W. S. Sherwill, (J. A. S. B. 1853, XXII, pp. 540, 611,) and Major J. L. Sherwill, (J. A. S. B. 1862, XXXI, p. 457). Both relate to the Singalelá range and the higher valleys south of Kanchanjanga. Several visits have been made to the Cholá and neighbouring passes, but no accounts have been published of any of them, and neither of the Sherwills makes more than passing mention of the fauna of the country.

In the autumn of 1870, I had at last an opportunity of devoting three months' leave to the interior of Sikkim. At the same time I

\* I learn from Colonel Haughton that an account of Captain Chamer's journey has appeared in the "Sporting News" of the present year. I have not had an opportunity of reading it.

learned that Captain Elwes, who had come from England mainly in order to study Indian ornithology, had been staying at Darjiling since the commencement of the monsoon, and was anxious to penetrate into the interior, and that Colonel Haughton, the Commissioner, had written to the Rájá of Sikkim to ask him to give Captain Elwes all the assistance in his power. As we had nearly the same objects in view, we agreed to travel together.

The time at our disposal, August, September, and October, was decidedly unpropitious. All travellers in Sikkim have described the disadvantages of the rainy season; both Dr. Campbell's and Captain W. S. Sherwill's accounts of their journeys in the autumn are a record of constant discomfort. But there was no help, an Indian official must take leave when he can get it, although that be at the worst season of the year.

Our principal object was to reach the upper branches of the Tísta valley, where the rains are lighter, and the climate cool in consequence of the elevation. Here we expected to find a very different fauna from that of Sikkim proper, and belonging to the dry central Asian region. A glance at the map of Sikkim will shew that the long hot tedious march up the valley of the Tísta might easily be avoided, and Láchúng reached, by crossing the Choló range, which forms the eastern boundary of Sikkim, by the Yák-lá, or one of the neighbouring passes, marching northwards along the flank of the Chúmbi valley, and recrossing into Sikkim by the Tankra-lá. The only difficulties in the way are the necessity of avoiding the Tibetan guard when entering the Chúmbi valley, and the finding of a road from the one pass to the other without passing through the town of Chúmbi. As regards the first point, Mr. W. S. Atkinson and Mr. Clarke, who visited Yáklá in 1867, found no guard whatever there, and were led to believe that none was usually stationed at this pass. The other difficulty would certainly have appeared the more formidable of the two, had we had much experience of the Sikkim mountains, but having none, we scarcely troubled ourselves about it, supposing that it must be possible to march along the flank of the range without descending into the deep valleys.

Elwes, after much trouble, debate, and enquiry, had learned that the plan was feasible, that there was a pass nearer to Darjiling and easier than Yáklá by which we could cross, and he secured the services of a man, a native of Chúmbi, named Chúdá, who promised to shew us the road from one pass to the other. This man subsequently proved to be an arrant impostor, he did not appear to have any acquaintance which the Cholá range, and we afterwards learnt that he had hired himself as our guide on the strength of two journeys he had made between Chúmbi and Darjiling as a salt carrier. He did not even know the road by which we went, the marches along which, as given to us in Darjiling, proved quite inaccurate. This well illustrates one of the difficulties in the way of travelling in Sikkim. Very little confidence can be placed in any statements as to roads, and especially as to distances, made by Bútias at all events. This is partly due to untruthfulness, but more perhaps to that want of accurate ideas about time and distance which is so characteristic of savage and semi-savage races.\*

Our plan was therefore to march across part of the Bútán Dúars east of the Tista, and through the south-eastern corner of native Sikkim to a pass called Jelep-lá, and thence, if practicable, to make our way to the Tankra-lá along the east side of the Cholá range.

The arrangements about coolies and provisions had been pretty nearly completed by Elwes, before I reached Darjiling, thus saving much trouble and delay. I mention them because our experience may be of service to future travellers. The coolies were partly Nepálese, partly Bútias and only a few Lepchas. The head-man or sirdar, Gúruk by name, was a Sikkim Bútia, and a good specimen of the race, tall and stout. He proved an excellent man,

\* Few, if any, savage and semi-civilized races have any conception of distance, as we understand it. They consider places far or near in proportion to the time necessary to reach them. I once had a good instance of this in Sikkim itself, when ascending Tonglú. As I was going up I asked one of the coolies the distance to the summit from the monastery at Simonbong. He said ten kos. When returning and about one kos below the top I asked the same man how far we had to go to the monastery, and he replied three kos. Why, I said how is this, yesterday you told me it was ten kos to the top, to-day you make only four. Oh! said he, it is ten kos to go up, but only four to come down. In connection with this, it may be borne in mind that it is the practise of many civilized nations to reckon their distances by hours.

hard-working, and not given to making difficulties. We had also a second head man or daffadar who, in charge of sixteen coolies, Lepchas and Bútias, with rice and spare stores, was sent direct to Láchung viâ Tamlung. Another daffadar was in charge of the Nepálese coolies, of whom we took ten, in the hope that they would go with us into Tibet, if the Bútias were afraid to cross the frontier. Neither of these daffadars proved of much use.

Most of the provisions were packed in bamboo Lepcha baskets, lined with leaves to keep out the wet, and each man had a "goung," a cane mat about $4\frac{1}{2}$ feet by 3 in size, made of leaves between two net-works of split bamboo, serving to protect both him and his load from the rain.

We had arranged to start from Ging on the 13th of August, but as I was not very well, Elwes went on to catch up the coolies, who had preceded us by three days, and I left next morning. I quickly rode down to the Rangít bridge and along the road on the right bank of the Rangít leading to the Tísta. But before I had proceeded far beyond the Rangít bridge, I had to send my pony back, for the road was blocked up with landslips, and the bridges had been washed away by the rain, and from this point I walked on to the Tísta bridge, about $1\frac{1}{2}$ miles below the junction of the Rangít. The heat was great, as the sun was shining brightly. After crossing the fine cane bridge over the Tísta, I found my Bútia shikari and a mule which Elwes had sent down for me from Kálingpúng. He had found nothing to carry him up, and was nearly knocked over by the heat in the steep climb of 4000 feet without a break.

I ascended easily enough, thanks to the mule Elwes had with some difficulty very kindly procured for me, and I reached the rest house at Kálingpúng about 4 P. M. The left bank of the Tísta is here in the Dáling Dúar, formerly part of Bútán, but annexed after the war of 1864. The rest house, or dák bungalow, is a large bamboo hut. Elwes had gone on some sixteen miles to a place called Phýúdong, where we had arranged to overtake the coolies, and he had promised to wait there for me next day.

Kálingpúng is a civilized place with a police guard. It is not visible from Darjiling, but can be seen from the Lebong spur west

of the Rangnú valley. It is on the crest of the spur immediately east of the Tísta, and just above the confluence of the Tísta and great Rangít rivers.

August 15th. I again borrowed a mule and started as soon after daybreak as I could get the three or four men who were with me to move. The road led for about ten miles in a north-east direction along the flank of the great spur which runs up to Damsong, passing mainly through clearings in which maize, marwa and hill rice were growing luxuriantly. At length the path ascended to about 6000 feet, leaving the clearings and traversing the splendid open forest which clothes the outer hills of Sikkim at this elevation. Here as usual leeches abounded, but as the day was fine they were not troublesome. I found three or four land shells and a very remarkable slug of an undescribed genus allied to *Vaginulus*, pale brown in colour with a carinate back.

I now sent back the mule I had been riding and walked on, leaving the road to Damsong on my left. After about four miles through the forest, the path descended to clearings again and I met Elwes coming to meet me. He had found everything in order, and we soon reached Phýúdong, a small cluster of good houses with a little open flat covered with grass on which our tents were pitched.

We had two tents, one for ourselves, the other for our men. The first was made out of an old Jabbalpúr *shildári* by cutting it down to 8 feet square and 6 feet high in the middle, removing the lining and replacing it by blanket, and fitting very light bamboos instead of the absurdly heavy ones which are usual in the plains of India. This tent proved both warm and waterproof; it had but one fault, weight, as when wet it required two coolies to carry it. The other tent for our men, of Darjiling manufacture, was much larger and made of American drill. It was light enough certainly, but it was far from waterproof. We had dispensed with tables, chairs and cots, in order to travel as lightly as possible.

Phýúdong is rather a pretty place on the southern slope of the Rishet valley which here forms the boundary between the Bútan Dúars and Independent Sikkim. The stream at the bottom of the valley runs west towards the Tísta, through dense tropical jungles:

from about 1000 feet above the stream or between 2500 and 3000 feet above the sea up to nearly 6000 feet of elevation, the greater portion of the slopes, where they are not too steep, are either actually under cultivation or bear marks of having been so recently, whilst, above about 6000 feet, the head of the valley and a dark stripe on the crest of each spur consist of magnificent unbroken forest. This is the invariable appearance of all valleys in the outer ranges of Sikkim, except where, as around Darjiling, they have been ruined by reckless woodcutting.

16th. On preparing to start next morning, Elwes found, to our great annoyance, that a very nice mountain aneroid, which he had brought, had disappeared, having doubtless been stolen. This was very unfortunate, for it was our only barometer, and although the elevations in the upper Tista valley were all determined by Hooker, this is not the case on the Chola range. Our route led in a sloping direction down to the Rishet stream, and thence up the opposite side of the valley to Rhinok, which, from Phyardong, looked barely two miles distant. We started about 8, which was the earliest time at which we could collect our coolies, for all the hill men, like Burmese and other Indo-Chinese races, and like several of the pseudo-aboriginal tribes of India itself, but unlike the Hindús, always eat before starting. We rapidly descended to the river by a road, bad after the carefully zigzagged paths of British Sikkim, but which was magnificent as compared to the tracks we encountered subsequently. On my way down I captured a snake and just escaped being bitten by it, which made me feel uncomfortable for the moment, for it was a most venomous looking brute. It proved to be *Psammodynastes pulverulentus*, a snake which appears made to prove that it is by no means so easy to distinguish between venomous and non-venomous snakes as is commonly supposed and asserted. Really it is not dangerous, but not only has it the flattened head and broad jaw which are usually characteristic of the venomous snakes, but it possesses a pair of long fangs in front of the jaw, so that even after capturing it and examining the teeth, it is difficult to distinguish it from a poisonous species.

The stream afforded a delightful bath, the water not being so cold as to be unpleasant in the hot steaming valley. There were

but few birds, the little plumbeous redstart, *Ruticilla fuliginosa*, was running over the rocks like a dipper, and a superb *Ceryle guttata*, the large black and white kingfisher of the Himalayan valleys, flew past. We halted at the stream for breakfast, and I should have preferred waiting there till the afternoon, but we found that so long as we halted, the coolies did the same, and that when ordered to go ahead, they did so to the distance of perhaps 200 yards and then sat down to wait for us. Rain was threatening, (the weather hitherto had been fine) and we therefore started up the steep ascent to Rhinok. It proved a hot climb through old clearings now overgrown with wormwood, through the close masses of which no wind can penetrate, whilst it affords no shelter from the sun's rays. We camped at Rhinok in an open clearing, surrounded by wormwood bushes. Our coolies got into houses and sheds scattered about in the neighbourhood. We were informed that a Kájí (the Sikkim corruption for a *qází*) had been sent by the Rájá of Sikkim to meet us here at the entrance to his territories, rather an evil omen, as shewing that the whole of our intended route, which we had tried to keep secret, was perfectly well known to the people in Chúmbi. I had fully expected this, however, for before I left Darjiling I found the story had oozed out some weeks previously.

17th. A night's rain was succeeded by a dull morning with a steady downpour, and our coolies commenced a series of most amusing manœuvres to gain a day's halt. First we had to receive the Kájí, who appeared about 8 o'clock, accompanied by another official who brought us a large present of vegetables, rice, flour and marwa. The Kájí produced a letter from the Rájá written in Tibetan (the court language of Sikkim) on tough silky Tibetan paper, and wrapped in a handkerchief of white Chinese silk, the proper style of envelope in good Tibetan society. The letter was read by the Kájí and, where necessary, interpreted by him into colloquial Tibetan, and then repeated to me in Hindustani by our headman Gúruk, who understood ordinary Tibetan well, although some of the more flowery court phrases were evidently not familiar to him. The purport of the letter was, that the Rájá was greatly pleased to hear that we were coming to visit his country, and that

he would afford us every assistance in his power, but that he begged us not to attempt to cross the Tibetan frontier. The Káji was to accompany us to the Cholí range and to take care of us, which, being interpreted, of course meant to see that we did not cross into Tibet.

The interview lasted some time; after it was over, we determined to breakfast and start. But it was useless sending for the coolies, one man after another appeared with some excuse or other. The rain would cease soon, the road ahead was impassable from its slipperiness, the leeches were terrible and we should be eaten alive, &c. &c. Time went on till it was 11 o'clock, when a Nepálese cooly, who had been over the road before, declared that it was useless to start now as we could not possibly reach Chúsáchen, the next halting-place, before night, and at length we had to give in. I went out and shot two or three birds, but nothing rare: *Ægithaliscus erythrocephalus*, *Grammatoptila striata* &c. In the afternoon there were some large landslips in the valley, and although they were two or three miles distant, the noise was like that of thunder.

18th. There was an improvement in the weather, and we started early. One of the coolies was ill, and I remained behind for some time to make arrangements with the village *mandal*, or head man, to take the poor fellow in for a day or two. Whilst waiting, a flock of hill monkeys, (*Inuus pelops*?) climbed into some trees above the camping ground and I watched them there for some time. They are far less active than the common Indian *I. rhesus*.

Starting at length I climbed to the crest of the range north of the Rishet, perhaps 1000 feet above Rhinok, and found myself on the slope of a deeper valley, that of the Rangchú, on the opposite side. The path led for a mile or two along the side of the hill through high forest swarming with leeches, until after passing a spur it descended rapidly to the valley of a large tributary of the Rangchú; the road beyond this to the Sikkim frontier lay up a long spur between the Rangchú and this tributary.

After a bath and breakfast we proceeded to climb the opposite side, and to our surprise reached Chúsáchen in about an hour. The march was in fact a very short one, and might with the greatest ease have been accomplished the day before. We went

about 1500 feet up the slope of the hill above Chúsáchen to a hut, in which we had a bamboo platform or machan built to sleep upon.

From just above the place where we encamped there was a fine view, much impeded by clouds, over the Tista valley to the westward. On a hill in front, the slopes of which were for Sikkim unusually gentle, stood the large village of Dikiling, its houses and clearings scattered over three or four square miles of country. Throughout lower Sikkim the houses of a village are not placed close together, as in India, but are scattered about, each house apparently in the midst of its own fields; and different houses in the same village are frequently long distances, as much as one or two miles, apart. The only exceptions to this which I saw were in the villages of the Láchén and Láchúng valleys. As the usual object in placing houses together is mutual protection, this appears to indicate that the attacks of enemies have been uncommon, except in the valleys close to the Tibetan frontier, which, in fact, belonged to Tibet formerly.\*

August 19th. Our route lay up the spur: rain began almost immediately after we started and continued steadily throughout the morning; it had also poured nearly the whole night. We soon entered the usual high forest, with but little underwood, which marks an elevation of 6000 to 8000 feet above the sea, and in which the leeches are met with in the greatest profusion. They can be kept off to a considerable extent by tying tobacco leaves round one's ankles. In addition to this, I used to powder the inside of my gaiters with snuff, but it is impossible to escape them altogether. After traversing forest for four or five miles, we descended about 1000 feet into clearings, and emerged into a small side valley, leading into that we had left behind at Chúsáchen. The rain had ceased and we breakfasted at some Bútia houses. The coolies had made up their minds to halt at this place, however we induced them to go on and reascended into the forest. After three or four miles we reached Kaphú, the last permanent village on the road; beyond this we were told we should meet no one until we arrived at the upland pastures to which the cattle had been taken for the summer.

\* Hooker's Himalayan Journals, II, 42. (2nd Ed. II, 64.)

At Kaphú there were but two houses. In one of these there was some person sick, and as we could not find a spot on which to pitch our tent, we established ourselves in the other, and our people esconced themselves beneath the house.

20th. Leaving Kaphú, the path, so well worn as to prove the very considerable traffic which passes by this route, led rapidly upwards. The weather was fine at first, but everything was soon shrouded in mist, which not long afterwards became rain. We climbed steadily for about four hours, passing from the open forest to an underwood of dwarf bamboo, which became shorter and closer as we advanced. We passed one small marshy open glade with a log hut standing in it, and soon after coming amongst tree rhododendrons, we came to another very small opening, apparently natural, in which was a second shed, a roof of logs without sides. In this spot, which bears the name of Jelúk, we determined to halt, although our march had been short, as the coolies had had a steep climb. The afternoon passed in steady rain and mist, and the air was chilly. As Elwes's aneroid had been stolen at Phýúdong we could but guess at our elevation; but the circumstance that we had fairly entered the rhododendron forest with an underwood of dwarf bamboos, and that we had left nearly all the leeches behind, together with the close resemblance of the forest to that on the top of Tonglú led us to estimate our height at about 10000 feet, or perhaps a little more.

In the afternoon Elwes climbed somewhat higher and came upon pines and junipers. He also shot a female of the Sikkim horned pheasant, *Cerionis satyra*, a very rare bullfinch, *Pyrrhoplectes epauletta*, and some other good birds. I meantime had met with nothing but one or two common *Leiotrichinæ* such as *Siva strigula* and *Yuhina occipitalis*, but Elwes's shikari brought in the rare *Cochoa purpurea* and 2 male *Cerionis*. The pheasants were fine birds though in very poor plumage. All the Darjiling Bútias and Lepchas call them Monál, distinguishing *Lophophorus Impeyanus*, which is also found in Sikkim, as the blue Monál.

We pitched our tent in a marsh, leaving the shed for our men, and we had a small platform-like cot or *machan* of bamboo built inside the tent upon which to sleep. We also determined to make

a short march the next day into the juniper region, and to halt there.\*

21st. It was clear at sunrise, but soon clouded over, indeed from the first the only view was towards the Tísta. We went only about a mile up the steep path, coming soon upon dwarf juniper, *Juniperus recurva*, and silver fir, *Abies Webbiana*, which soon increased in size and abundance, until at about 11000 feet, (estimated) the dwarf bamboos for the most part disappeared, and the forest, no longer so high as below, consisted of the silver fir and rhododendrons of various kinds. At about this elevation, we came out into an open space, on the narrow ridge of the spur, gay with a brilliant yellow composite flower, on which many of the peculiar red-tailed green honey-suckers, *Ethopyga ignicauda*, were feeding. The lovely *Myzornis pyrrhura* was common; I also shot *Conostoma æmodium*, a thorough crateropodine in its habits despite its thick bill, *Pyrrhula aurantiaca* and *Trochalopteron subunicolor*, a common Darjiling laughing thrush, which I was rather surprised to find at this elevation. I obtained a few land shells amongst the dead leaves, including a species of *Alyceus*, a *Diplommatina*, and a discoid *Cyclophorus*, the two former certainly undescribed, a peculiar green *Helix* and a *Glessula*. I do not know of any previously recorded instance in which *Cyclophoridae* have been found at so great an elevation, and as *Alyceus* and *Diplommatina* are typically Malayan, none being known in the plains of India, their presence at this height affords a remarkable instance of the extent to which this damp-loving fauna has crept up the slopes of the Sikkim Himalaya.

August 22nd. The name given to us by our men for the night's encampment was Lingtú. I suspect this is really the name of a summer cattle station farther up the ridge. It poured all night, and as our coolies had no house to get into they improvised huts of boughs. All the men we had were Bútias and Nipalese, who are both hardy races, and stand cold much better than the Lepchas.

\* At this place and at many others on our road we met Bútias carrying heavy loads of salt and coming from Chúmby. There is a considerable traffic between Chúmby and Darjiling entirely carried on by coolies. The exports into Chúmby are, I believe, sugar, rice, and a little English hardware. The import of Darjiling tea into Tibet is absolutely prohibited.

The path continued steep for another 1000 feet, and led up a craggy spur, too steep for trees in most places. Had the weather been fine, the view over Sikkim would, in all probability, have been magnificent, but, unfortunately, a dense mist shrouded everything. On the top there was much rhododendron scrub, but the road now led along the crest of the spur through small rhododendron trees, and then emerged into open grassy valleys with patches of forest formed of rhododendrons and silver fir. Here, at an elevation of 12000 feet, I first came upon traces of former glaciers in the shape of small pools in marshy hollows dammed up by what were evidently little moraines. I had been carefully watching for marks of glacial action at a lower elevation, but could find none whatever; if any ever existed they have long since been obliterated by the tremendous rainfall and consequent disintegration and denudation of the surface. In the interior of Sikkim, as will be seen hereafter, this is not the case; there glaciers have left unmistakable marks at least 6000 feet lower.

Elwes was, as usual, ahead; I had marched along quietly, shooting birds, looking for landshells, &c. On my road I met the Kaji's servant bringing me a bamboo pot of marwa, which was very agreeable, even in the cold climate we had now reached at 12000 feet. The Kaji had been very polite, and had supplied us with marwa at each day's halt, by no means eschewing the beverage himself. Almost every one who travels in Sikkim takes a liking to this most refreshing drink, however much he may despise it whilst soda water is still available.

In the grassy valleys were large herds of cattle driven up to this elevation for pasturage in the summer; in the winter they are taken down to the warm valleys. During the rainy season I doubt if any terrestrial animals can exist in the forest between 4000 or 5000 and 9000 feet, they would be in all probability destroyed by the leeches. It is certain that the only mammals found are squirrels, monkeys, and a few other arboreal forms; even the pheasants are wanting, after the Kalij, *Gallophasis melanonotus*, is left at about 5000 feet\*, until *Cerionis* is met with at nearly 10,000 feet.

\* Jerdon gives for the range of this *Gallophasis* 3000 to 8000 ft., Beavan (Ibis 1868, p. 381,) 2000 to 7000. I suspect this is in the cold season, when I

We entered an open grassy valley with rounded down-like hills on each side, and no high mountains in sight. Patches of fir and rhododendron forest were scattered about, and down the centre, marshy in places, a stream ran over pebbles and rounded blocks of rock. The scenery was more like the mountainous parts of Europe than anything familiar to dwellers in India. It looked a paradise for a sportsman, but unfortunately there were no deer in the forest, nor trout in the river. At a halting-place called Gnátong, where was the usual wooden shed, we pitched our tent, after clearing away a space amongst the flags and shrubs which covered the marshy ground, but it was so swampy that we were compelled to make a *machan* to sleep upon.

The Kaji told us that the pass was one march ahead from this, and that from the foot of it a path led along the Sikkim side of the range to Chúmanáko close to the Cholá pass, also that he had just received orders from Chúmbi to accompany us along the range, on the Sikkim side however.

23rd. We resolved to go ourselves to the Jelep pass, as if to visit it, and to see if there was a guard or not, taking our camp only to the foot, or Lagyep. We accordingly started early and walked up a long gentle ascent and over some grassy hills, and then descended through rhododendron scrub to the banks of a pretty little lake, $1\frac{1}{2}$ to 2 miles long, called Bidan-Tso. This lay in a valley between the hills we had just crossed and the steep, high and craggy dividing ridge between Sikkim and Chúmbi in Tibet. A line of watershed crossed the valley just where our road traversed it, the lake discharging its waters to the south-east, whilst a stream, coming down from the frontier range just above the head of the lake, runs to the north-west down the valley. Our road led to the north-east up the valley of this stream. Hitherto we had not ascended much since starting in the morning; at any rate the descents had very nearly equalled the ascents, but from this spot we began gradually to rise. The lateral valley we had entered was much more craggy than those left behind, its southern or

have myself seen them decidedly higher than in the rains. During the monsoon I think they keep below 5000, and that *Arboricola ruficularis* does the same, whilst *Cerionis* rarely descends below 9000.

rather south-eastern side being a dense mass of rhododendron scrub up to an elevation of perhaps 14,000 feet, while the north-western hill side was bare. Here we first caught sight of the giant Sikkim rhubarb, some idea of which may be gained from Captain W. S. Sherwill's figure in J. A. S. B. 1853, p. 618\*, its "pale pyramidal towers," as Hooker calls them, being very conspicuous, scattered over the hill sides more than a thousand feet above, and looking in the distance like white posts. Gradually ascending, we started from amongst the rocks a flock of snow pigeons, *Columba leuconota*, but birds were not numerous, *Calliope pectoralis* and *Propasser thura* being the most conspicuous.

We slowly ascended to a barren ridge forming the crest of the Jelep pass, at about 13,000 feet or rather more; to the south-east was a little lake amongst high crags, to the north some steep masses of rocks; no snow was visible. On the crest of the ridge some 20 Tibetans were posted to oppose our passage; they were quite unarmed, except with their knives, and remained seated around the pile of stones which marks the frontier; their Jong or Captain, a round-faced rosy Tibetan, with by no means an intelligent countenance, in the centre. He appeared to take no notice of us, and seemed solely occupied in muffling himself in his huge cloak to keep off the wind, which blew piercingly over the exposed ridge we were on. We subsequently learned that the guards, Jong and all, I believe, were merely villagers, who were ordered up to guard the frontier, and singularly enough, neither on this nor on any subsequent occasion did we meet with soldiers such as Hooker describes.

To the east, the view was poor, everything at a distance being enveloped in cloud. Elwes, who reached the top a few minutes before I did, had a glimpse during a partial break of a broad valley, thickly covered with forest. Immediately beneath was a small lake, around which yaks were feeding. Many flowers grew in tufts amongst the stones on the crest of the pass, and we appeared to be nearly on a level with the giant rhubarb plants,

\* The upper bracts are usually a very much paler yellow than they are represented in Captain Sherwill's figure, and in the distance they look quite white. The upper portion of the spire too is often longer and more cylindrical than in the plate.

whilst masses of scrub rhododendron ascended all hills with a northern exposure to a little above our level; we consequently estimated the elevation of the Jelep pass at between 13,000 and 14,000 feet. Two ravens perched on some stones not far from us.

We sat down and eat some breakfast we had brought with us, and then Elwes became disgusted at the stolidity of the Tibetans, and determined to see if they could be induced to recognise our existence. I should have mentioned that two or three questions put to them through one of our own men had only elicited short replies from one or two of the guard, the Jong remaining as insolently abstracted as if he expected immediate absorption into Nirvana. So to teach them a lesson of politeness, Elwes walked rapidly across the frontier and began descending the opposite side. The men were utterly taken by surprise, they stood up and crowded round me, then with one accord rushed after Elwes, scrambling rapidly over the rocks, despite their long cloaks, and, finding that expostulation was useless, they flung themselves down in the path before us, beseeching us to return, and expressing to us by most emphatic gestures, that all their throats would be cut if we persisted in entering Tibet. With all this there was no attempt at violence or threats, they got in our way as much as they could, but that was all. Hereupon we halted and explained to them as well as we could, through a very bad interpreter, that it was not polite to sit and stare at strangers without taking any further notice of them.

I believe that this little incident had an excellent effect, for, in all subsequent visits to frontier posts, we were received with the greatest civility and politeness, and I am convinced that we rose in the estimation of the Tibetans by insisting on their treating us with proper respect.

We walked back from the pass, climbing up to the little lake already mentioned on our way. It is one of the small rock basins which are so often found beneath peaks of mountains, and which are of apparently glacial origin. I suspect that they are formed when the snow line extends but a short distance below the peak, and the glacier is just sufficiently long to hollow out the rock basin in which it rests. At least I have seen a very small glacier

in Norway, terminating in the basin of a lake apparently hollowed out by itself.\*

After examining some of the huge rhubarb plants, the seeds of which were unripe, and looking at some yaks which were browsing in the little alpine valley by which we had ascended, we retraced our steps and found our tents pitched in the broad valley we had traversed in the morning, on a nice patch of dry turf, close to the stream which runs down from the pass. We determined to halt at this place for a day, and examine the neighbourhood.

August 24th. It poured all night, and in the morning there was snow on the peaks to the north of us, around the Yaklá.† We walked round the Bidan-Tso, which proved one of the best examples of a glacier lake I have ever seen. Just at the upper or north-west end, there is a horse-shoe shaped moraine, which has formerly enclosed a second lake, now converted into a marsh. At the south-east end of the Bidan-Tso is a second well marked moraine, damming up the lake. From the end of the lake a stream runs down into Bútan, the frontier of which is only a mile or two distant, so that at this spot, the Sikkim, Bútan and Tibetan territories all meet.

Birds were not numerous, and *Raptores* singularly scarce; I only once saw some vultures sailing far overhead. Once or twice swifts appeared, doubtless *Collocalia fuciphaga*, which indeed I shot a few days afterwards, and the Cashmere martin, *Chelidon Cashmiriensis*, was common. I once or twice saw the Nipal wren, *Troglodytes Nipalensis*. In the scrub *Trochalopteron affine*, *Phylloscopus lugubris*, and one or two other species, *Merula albocincta* and *Propasser thura* were the principal birds; and on the hill sides *Calliope pectoralis*, *Anthus rosaceus* and *Ruticilla frontalis*. On the banks

\* There is a considerable similarity between these hollows and the "cirques" of the Alps and Pyrenees. In the last number of the Quart. Jour. Geol. Soc., 1871, p. 312, the Rev. Mr. Bonney has shewn reasons for believing that such hollows are due to the action of running water, and not to glaciers. But it is simply impossible for running water to excavate a lake basin, and very difficult, so far as I can see, for it to have formed the vertical cliffs which usually surround the hollows. On the other hand Mr. Bonney is probably quite right in supposing that these and similar results of erosion are due to a combination of different causes, such as rain, streams, and glaciers, and not to one alone, but I cannot help believing that glaciers have aided and very considerably aided in producing the present contour.

† Lá is a pass.

of lakes and streams *Chimarrhornis leucocephala* was far from uncommon, but there were no waders nor wagtails. The only natatorial bird we saw was the "Brahmini duck," *Casarca rutila*, which doubtless breeds around these lakes.

Both ravens and crows were seen, and I came across two choughs, *Fregilus graculus*, a few days later. In the pine woods were blood pheasants, *Ithaginis cruentus*, and on the trees three kinds of crested tits, all rarities, *Lophophanes Beavani*, *L. dichrous* and *L. amodius*. The only mammal noticed was a *Lagomys*,\* and not a single fish, amphibian, or reptile was observed. Indeed the fauna of this elevation appears decidedly poor, and this, so far as the avi-fauna is concerned, is a matter of no small interest, for it goes far to prove that the large majority of the migratory birds, which visit the plains of India during the winter, cross the Himalayas and breed in Tibet and Siberia during the summer. This has lately indeed been confirmed by the discovery of several Indian *Phylloscopinæ* in Siberia, yet many *Phylloscopi* and *Reguloides* breed in the rhododendron scrub of the Sikkim mountains, for we found them with their young. Indeed it is probable that all the birds which we noticed on the Cholá range breed on the hills, because the range does not come in the path of the migratory species, which of course pass down the north and south valleys such as that of the Tista.

The whole of the rocks are very felspathic pale-coloured gneiss, the foliation having a general but varying dip to the eastward. At the Jelep-lá the dip is N.10 E. about 20°, and usually on the crest of the range the angle of inclination is very low. Near the Yák-lá it is in places quite horizontal. A similar horizontality of the gneiss has been noticed on the Singale-lá range by Captain W. S. Sherwill (J. A. S. B., 1853, p. 618, and sketch No. 3, beside the map, p. 540). Curiously enough, the remarkable horizontal foliation appears only to have been observed, both on the Cho-lá and Singale-lá ranges, upon the very crest of the dividing ridge.

\* Of course others occur, but they are nocturnal or burrowers. A day or two afterwards I shot a snow pigeon, *C. leuconota*, and left it in a hole amongst some rocks whilst climbing a small ridge. On redescending I found only feathers remaining, the pigeon having been carried down the hole probably by a weasel or some other small carnivore.

August 25th. A lovely morning, the first really fine one we had had since leaving Phýúdong. From our position we could only see a few peaks in the neighbourhood; on one of these only there was snow. It was probably Chúmanáko, known in Darjiling as Cholá.\* We had determined to march north along the range, as far as we could, in the hopes that we might thus find a road to Láchúng without descending into the hot, steaming, leech-infested valley of the Tista. Our course led north-west across a pine-clad valley, down which to the south-west we had a view of the Nemi-Tso, one of the largest and loveliest lakes in Sikkim, about 2 miles long, lying in a deep gorge, all the sides of which are covered with dark pine forest. Reascending we came upon an open marshy plain, chiefly a peat moss with a tarn in the middle; evidently a lake bed dammed at the end by a glacier moraine and nearly filled up. On the drier grassy hillocks I found three kinds of butterflies,† tempted out by the fineness of the day. From the opposite end of the marshy ground, a path leads eastward to the Gnatui-lá, a pass said to be intermediate in height between the Jelep-lá and Yák-lá, but which is not much used for traffic. Rain now came on and after climbing for 2 or 3 miles around the head of a deep ravine, we halted at a spot called Sharáb where some overhanging rocks, forming a "lháp," or cave, afforded good shelter for our men. A small stream running from a little lake close to our camp supplied water, and our men had a wonderful power of discovering firewood in most unpromising places. We here heard that the Rájá of Sikkim was on his road to Chúmanáko, on the Sikkim side of the Cholá, to meet us, but that it was still two marches from the place where we halted.

Here we had an illustration of the short distance of all these passes from Chúmbi. We had despatched a man on the preceding morning to fetch some flour. A messenger came with a bag of flour about 2 o'clock in the day, and assured us that he had left Chúmbi with it after the arrival of the messenger on the previous

\* Cho-lá is the pass, Chámanáko or Dobendikhán the peak north of it.

† *Parnassius Jacquemontii*, a peculiar small variety of *Satyrus Padma*, and a new species of *Argynnis*. I am indebted to Mr. W. S. Atkinson for the names.

afternoon. The distance can scarcely be more than 20 miles at the outside. In fact the town of Chúmbi, the summer residence of the Sikkim Rájá, appears to be little more than a day's march distant from any of the eastern Sikkim passes from the Tankra-lá, close to Láchúng, to the Jelep-lá. If this be the case, it is evident that by far the nearest road from Darjiling to Láchúng is *via* Chúmbi.

26th. From a ridge near our camp, Kinchinjanga was visible in the early morning; it was the first time I had seen it since leaving Darjiling. Our road on starting led over this ridge, and into a large valley in which is a fine lake, the Tanyek-Tso.\* It lies higher than the Nemi-Tso and above the limit of trees. The stream running from it is said to join the Rangchú.† Near this lake 3 monals flew up from the hill side, and settled amongst the rhododendron scrub. As this scrub covers some most difficult ground, chiefly consisting of immense blocks of rock, often loose, and concealed by thick bushes, I sent my shikarí after the birds, but he failed to shoot them.

Another longish ascent led to the verge of a deep valley up which passes the road to the Yáklá. Like all the other glens on this part of the Cholé range, the southern side is covered with rhododendron scrub, the northern being bare. The scrub abounds in the Scotch parsley fern, *Cryptogramme crispa*. We descended to the bottom and encamped at a spot called Byútán, most of our coolies joining some yak herdsman whose black blanket tents were pitched on the slope above us. We were just above the highest trees, consequently above 12000 feet, but I found a toad (*Bufo viridis*?) and a large slug near our camp.

The Yák-lá is only a few miles from this spot and must be above 14000 feet high. It is said to remain open after the Cho-lá is closed by snow, but the Jelep-lá and Gnatui-lá remain passable still longer, indeed the latter is rarely interrupted for many days together.

27th. At Byútán we heard positively that the Rájá‡ was

\* The three lakes Bidan, Nemi and Tanyek are not marked in any map. All I believe far exceed in size Catsuperri lake, which Hooker was told was the largest in Sikkim, (Him. Jour., vol. i, p. 363.)

† The Rinkpo of Hooker's map.

‡ I use the term Rájá because it has been invariably applied to the ruler of Sikkim, although it is not correct to give a Hindu title to a Buddhist Indo-Chinese chief. I learn from Colonel Haughton that the correct Bútia title is Denjong Gydy-bo.

awaiting us at Chúmanáko. On a lovely morning, we climbed up beside the yak herdsmen's tents to a rather high ridge, whence there was a superb view of the Choló peak or Dobendikhán, in one direction, and of Kinchinjanga in another. This was the last really fine day we had for a long time. On the ridge we shot two large rose finches, *Pyrrospiza punicea* and *Procarduelis Nipalensis*. A long descent, the road down which had been cleared for us, led to the Choló valley amongst firs and rhododendrons, and after crossing the stream we found two of the Rájá's officers in flowered blue silk dresses, awaiting us with a couple of mules, on which we rode about two miles up the valley to Chúmanáko. This is the spot where Campbell and Hooker were seized by the Rájá's officials in 1849. We found a tent pitched for us and the Rájá's half brother awaiting us; he had brought us a quantity of very good biscuits, far superior to Hindu "mitai," and dried fruits. The Rájá's tents were about a mile farther up the valley, and his brother asked if we would go thither in the afternoon, or would prefer deferring our reception till the next morning. We agreed to pay our visit in the afternoon, and about an hour afterwards two mules were sent for us, on which we rode up to the camp.

A durbar tent was pitched some distance below the Rájá's encampment, and, on entering it, we were again met by the Rájá's brother and conducted to the Rájá, who sat behind a kind of altar, on which joss sticks were burning, at the extreme end of the tent. Chairs were placed for us on the left; every body else, including the brother, remained standing. Both the Rájá and his brother were dressed in long robes of flowered yellow silk. The Rájá\* stared at us and paid no attention to our salutation, indeed during the whole interview he remained abstracted, gazing steadily in front, and only once or twice looked up when any remark of ours was repeated to him by his brother; and even then he did not utter a word. I do not believe that any discourtesy was intended; I have no doubt that the whole of his behaviour was in complete accordance with Tibetan ideas of sanctity. The highest human attainment, according to the Buddhist creed, is

\* The present Rájá is, I believe, the son of the man who imprisoned Hooker and Campbell; he succeeded in 1863-64.

complete abstraction from all sublunary matters, and meditation ; and the poor old Rájá, who appears to be a mere puppet, acts up to the Buddhist ideal. His brother, on the contrary, a much younger man, is a fine tall intelligent Tibetan, whose face beams with shrewdness. He is the picture of a diplomatist, and is probably the real ruler of Sikkim. Hooker's old enemy, the Dewan, or Pagla Dewan, as he is called in Sikkim, is no longer allowed to enter the country, but he is still a powerful man and holds the post of Governor of Chúmbi. He is greatly esteemed by all Tibetans, and all whom we afterwards met spoke of him with great respect. Doubtless the Rájá is much influenced by him, and it is to be hoped that he has learned by experience the folly of a policy of opposition to the British Government.

Our whole conversation was with the Rájá's brother, of course through an interpreter, Gúruk officiating in that capacity. We were first assured of the Rájá's satisfaction at seeing us, and then followed a string of questions as to our ages, occupations, families, &c. After this we requested to be allowed to proceed through Chúmbi to the Tankra pass, but we were assured that our entertainer had no power to permit us to go through Tibetan territory, that the orders of the Tibetan government, and still more of the Chinese government, were imperative, and we were begged to prosecute our Journey *via* Tamlúng and the Tista valley to Láchúng, and promised that the Rájá, in his own dominions, would give us every assistance, and have all the roads repaired. We were assured that there is no road along the range from the Cholá to the Tankra-lá, that it is only possible to go from one to the other *viá* Chúmbi, at the same time it was admitted that the distance is very trifling, not more than 3 or 4 days easy marching, by Chúmbi, whilst there is a long circuit to be made by Tamlúng and Chúng-tám. Of course we had to yield, though it was disgusting to be obliged to return to the hot valleys, and to lose so much time in them. Our assurance that the Chinese government had by treaty consented to allow Europeans to travel in all parts of its dominions was met by the reply that orders to the contrary had been received from Lhassa and Pekin, and was evidently not believed. It is to be regretted that no steps have been taken by the British Govern-

ment to convince the Tibetans of the existence of this treaty with China. This is not the fault of the Government of India, but of the British Government and its representatives at Pekin.

We returned to our tent after about an hour's interview, somewhat disgusted at the result, though it was only what we had expected. We determined to halt the next day and then start for Tamlúng.

28th. We borrowed mules from the Rájá in the morning and rode up to the Cho-lá, nearly 15000 feet above the sea. It is scarcely worth visiting, as it is in a hollow between two hills, and there is no view over Chúmbi. At the frontier chait we found an officer and a guard of about 15 men, who were civil, and greatly relished some whiskey we had with us. The morning was misty, and the peak of Chúmanáko or Dobendikhán completely concealed by clouds. On our way down we found the Rájá's brother waiting for us at the Durbar tent; he excused the Rájá's absence on the plea of ill health. We had again a long conversation, with enquiries upon all kinds of subjects. In the course of it, fuller details were given to us of the Rájá's position, and of an application he wished to make for an increased allowance from the British Government; some allusion had been made to this the day before, but I replied that we were simply travellers and had no authority to receive any communications intended for the Government; that all such should be made to Colonel Haughton, the Commissioner. Of course we could only repeat this. At the same time we added that doubtless the Government would learn with pleasure that we had been so well received and aided in travelling through the country, and that they would have been still more pleased had we been allowed to go through Chúmbi. Meantime cups had been placed before us and kept constantly supplied with buttered tea, not a bad drink in a cold climate, and after some time breakfast was brought. The first dish was little dumplings filled with chopped meat; after this we had large cups of a kind of macaroni stewed with a very nice gravy and some meat. Small plates also were placed before us containing red pepper, garlic and radishes, the two latter cut into small strips, and a pair of chop sticks, our endeavours to make use of which were only moderately

successful. Rather to my surprise, both dishes were excellent, as well flavoured as if prepared by a good European cook, with none of the excess in grease and spice which renders most Indian cookery so unpalatable to the European taste. After the meal a large present of blankets, carpets, silk, vegetables, dried meat, eggs, butter, honey, arrack and 6 sheep was brought for us. We had already apologized for having no present with us for the Rájá, for, not having any expectation of meeting him, we had left a vase and some glass ornaments intended for him at Darjiling, to be forwarded to Tamlúng, so as to meet us there on our return journey.

Later in the day the Rájá's brother came to see us at our tents. We shewed him guns, books, &c., and, like all the people in Sikkim, he especially admired the plates in "Hooker's Himalayan Journals," probably because he could understand them. Finally he took his leave, having deputed a fat round-faced little Lama named Kechú to accompany us to the Láchúng and Láchén vallies.

29th. We started down the valley on the following morning. For 5 or 6 miles the path leads through one of the loveliest valleys I have ever seen, the abundance of rhododendrons recalling an English shrubbery. It was here that Hooker collected in two days seeds of 24 different species. A pika (*Lagomys Roylei*), abounded in the underwood, and birds became very numerous as we descended. I shot *Collocalia fuciphaga*, *Ianthia rufilata*, *Chelidorchynx hypoxantha*, *Siphia strophciata*, *Lophophanes Beavani* and *L. dichrous*. The day before, Elwes had secured the Cashmere dipper *Cinclus Cashmiriensis* at Chúmanáko, and the two water redstarts, *Chimarrhornis leucocephala* and *Ruticilla fuliginosa*, were common on the banks of the stream.

We breakfasted at Barfonchen and then walked on to Lagyep. The path soon leaves the valley, and, after a long ascent of 1500 feet, we climbed down a steep spur to our halting-place, a small open space in an excessively swampy condition. It had poured all the afternoon and continued to do so all night.

30th. It was raining in the morning and only ceased to do so about 9 o'clock, by which time we had descended rapidly by a steep road from the rhododendrons to the oaks and chesnuts, and

from them to the subtropical flora. On the road I had a snap shot at a *Cerionis* running away through the trees, but I was, as usual, unsuccessful. We halted at the Rájá's rest house at Rangpo opposite to Tamlúng. The change from the cold of Chúmanáko was by no means unpleasant, but I imagine our coolies enjoyed it more than we did.

31st. We crossed the valley to Tamlúng, an easy march apparently, but really a very tedious one, being a descent of about 3000 feet, and an ascent of the same amount. At the bottom we crossed two streams, near their confluence, by cane bridges, and then climbed up through rice and marwa fields to Tamlúng. Here we put up in a large monastery, or Gúmpa, some distance west of the Rájá's palace. In front of the central building of the monastery there was a square grass plot, to the west of which a covered gallery, enclosed on one side, had been prepared for us. The monks or Lamas live in little houses scattered around the Gúmpa.

In the afternoon we visited the Gúmpa, which consists of two chapels, one on each floor. On the lower floor, in front of the chapel, is a verandah, with a row of praying-wheels along the railings which run along the front of it, and the rattle of these praying-wheels was incessant, as every monk walking along the verandah gave each of them a twist with his hand as he passed. In a side room one Lama was constantly employed turning a large praying-wheel by means of a treadle. Each chapel contains gilt figures of various Buddhas behind an altar, on which stand numerous brass cups of water; these are emptied every day at sunset and refilled in the morning. Immense trumpets, cymbals and other noisy instruments are employed in the acts of worship. In each of the chapels are libraries of Tibetan books, none of which are manuscript, but all printed in Tibet, mostly it is said at Jigatzi, from wooden blocks. The books consist of separate leaves of *Daphne* paper printed upon both sides, and all are either tales of Buddhist saints, or works on religion. The leaves of each book are secured between two boards, and the whole enclosed in a cotton cover.

Around the chapels hang the masks used by the Lamas at their great festival, when all belonging to the monastery collect from

the different places where they are dispersed, and a solemn dance takes place on the grass plot in front of the monastery. The masks are chiefly those of devils, the most gorgeous of all, with much gilding, being no bad imitation of the Satan of mediæval Christianity. The great festival, we were told, takes place in December, and is doubtless no other than our own Christmas, or, to speak more correctly, Yule.\*

But few of the Lamas were at the monastery at this time of the year, and the chief Lama himself was absent. Indeed during the greater part of the year many of the monks reside in their own villages.

In the afternoon we visited the Rájá's palace, which has been described by Hooker. It is surrounded by a wall, and the principal room within is a chapel.

September 1st. After much opposition we were obliged to allow our men to halt for a day, Kechú Lama promising to take us to Láchúng in 5 days, (which, I may add, he failed to do). I spent the day, a fine one, in labelling birds, writing up my diary and writing letters, for by good fortune we had found our postman here with letters from Darjiling for us. Several presents of vegetables, rice, fowls and the never-failing marwa were brought to us. Amongst the people who came to see us was Meepo, Hooker's old guide, now no longer a young man.

2nd to 5th. I shall describe very briefly our march to Chúngtám, which occupied 4 days. It was a very unpleasant one, through much rain and swarms of leeches. We took the wrong road at starting, owing to some mistake of the coolies, and instead of going directly over the hill behind Tamlúng to Selim and Ringám, we took the longer route *viâ* Tingchem. Our first halt was at that place, in a village which had been deserted on account of dysentery, which all the people in Sikkim dread greatly and look upon as contagious. Here we had not been expected, but as soon as we came upon the direct road at Ringám we found a Dewan awaiting us in an excellent bamboo house, which had been built for our accommodation,

\* Compare Journ. As. Soc. Bengal, Part I, 1865, p. 71, for an account by Major Godwin-Austen of the use of similar masks in a mystery play in Ladak. These festivals took place in spring and autumn.

and a large present of a goat, fowls, vegetables, rice, &c., and above all the carcase of a pig. This was the third present we had received in the day; we were in the most populous and the richest part of Sikkim, and the greater part of the population were Lepchas, who, whether from natural good nature, or greater friendliness for Europeans, were always conspicuous by their efforts to assist us. Throughout the Dewan's estates we found an excellent road cleared for us. We went on to Singtám (where we found another house ready) to sleep. Here the Tísta valley becomes suddenly narrow and steep, and for some distance there is but little cultivation. We should scarcely have reached so far as Singtám, but for the pig, the promise of which brought on the coolies at a wonderful pace, the Nipalese especially, who love pork as much as a Chinaman.

Above Singtám, near Nímga, the deep gorge, in which the Tísta (here called the Láchen Láchung) flows, first assumes the appearance of a glacier valley, an appearance which is increased at every turn, until above Chúngtám, at about 7000 to 8000 feet above the sea, all the sides of the valley are, in places, masses of bare rounded rock with the typical contour of "roches moutonnées." I must here pause to say that the views of this part of Sikkim in Hooker's Himalayan Journals do not convey by any means a correct impression. Like most lithographs of foreign scenes printed in England, the characteristic features are lost, the dense forest has vanished, and every thing is Europeanized, to coin a word. No one would conceive from the view of the valley below Chúngtám in Vol. II, p. 21, that the hills to the right and left of the woodcut are 5000 feet above the stream, and that the valley is really a deep gorge, clad in places with the densest tropical jungle. This, of course, in no way detracts from the excellence of Hooker's descriptions of the country and scenery.

From Singtám to Nímga the road is bad, from Nímga to Chúngtám it is worse, being partly over landslips, and for some distance in the bed of the river. A great landslip, about 1000 feet high, from the opposite bank, had converted a long reach of the Tísta into a pool opposite Nímga. I found a few landshells, including 2 or 3 *Alycæi* and a *Diplommatina*, but searching for them was

impossible in general on account of the leeches, which at every halt swarmed upon us. I saw a large Agamoid lizard about 2 feet long, which I failed to secure, but two fine *Japalura* were brought to me and one or two snakes (*Tropidonoti*). Between Nímgá and Chúngtám we found some of our coolies from Láchúng, and their duffadar. These men had been waiting for us for several days, and the duffadar had gone across the Tankra-lá to Chúmbi to look after us.

Hooker mentions terraces along the banks of the Láchén-Láchúng, the name here applied to the Tista, near this; I could only find traces of them, and they appeared to me due to deposits in the bed of the river when it has been dammed up by landslips, which it is occasionally to a great extent, as observed by Hooker and by ourselves. For upwards of a mile, in one place, we walked in the bottom of the valley over a great flat, in places nearly half a mile broad, of boulders and gravel, evidently deposited in this manner. The extreme steepness of the hill sides and the narrowness of the river valleys in this neighbourhood renders landslips more common and more effective in damming up streams than in most other parts of Sikkim.

September 6th. We marched from Chúngtám to Kedám, a short march up the Láchúng valley, but involving a considerable ascent, from 5200 to 6600 feet.\* There is a very marked change about this in the fauna and flora. As far as Chúngtám the common birds are the usual Sikkim forms, but at Kedám we found flocks of the Himalayan Siskin, *Chrysomitris spinoides*, and a titlark, *Corydalla striolata*, abounded in all open spaces. Indeed this may be considered the boundary between the Malay and Palearctic faunas, a boundary which, on the Cholá range, is 3000 to 4000 feet higher. Elwes climbed up the hill sides after ghoral, which inhabit the grassy and precipitous west slope of the valley, but although he saw some, he was unsuccessful in bagging any. Rain at night as usual.

7th. A dull misty morning with a little rain. We started about 7 o'clock and climbed over a very indifferent road, crossing the

\* These elevations and all subsequently mentioned are taken from Hooker's Himalayan Journals.

Láchúng river by the last cane bridge in this valley ; for beyond this the bridges which we saw were of wooden planks. The path soon led into open glades covered with high grass and shrubs. It was curious to note the difference in the two sides of the valley ; to the eastward all was dense forest, firs appearing at about 8000 feet, not far above our heads, whilst on the western slope grass prevailed, the trees being mainly restricted to patches of forest beside the ravines, somewhat like the "Sholas" of the Nilgiri and other hills in Southern India.

About 7 or 8 miles from Kedám, on crossing a small stream, we suddenly left our enemies, the leeches, behind, a little below the elevation at which firs begin to appear in the bottom of the valley. These trees appear at an elevation between 3000 and 4000 feet lower than on the Choló range, but the species are different, that seen lowest in the Láchúng and Láchen valleys being a very handsome tree, *Abies Smithiana*, which Hooker calls the spruce. It is far inferior in size to the silver fir, *A. Webbiana*, which only makes its appearance at about 10000 feet, but its elegant conical shape renders it a very beautiful and conspicuous object. A third pine *A. Brunnoniana*, also a handsome dark foliaged tree, appears at nearly the same elevation as the spruce, and around Láchúng, these two trees, with rhododendrons, form the greater part of the forests.

Láchúng well deserves Hooker's encomiums. It is in a broad part of the valley with, on all sides, the remains of the enormous glacier moraines noticed by Hooker, Vol. II, p. 103. These are peculiarly conspicuous from being, without exception, covered with grass, no forest apparently growing upon them.

We found the provisions sent forward from Darjiling a month before safe and in good order. Our men had put up in some stone sheds, with roofs of fir planks, on a grassy flat west of the Láchúng. The main village, built of fine houses raised above the ground in the usual Indo-Chinese fashion, is to the east of the river. The houses are close together as in Indian villages, not scattered over a large area as in tropical and subtropical Sikkim. This may be due to the people of Láchúng being Tibetans, but is partly in consequence, I should think, of their being agriculturists only to a very moderate extent. In fact the population of the Láchen and

Láchúng valleys have two principal sources of livelihood: 1st. Their yaks, of which they possess large herds. These, at the time of our arrival at Láchúng, were far away in the mountains around Momay Samdong and Yeomatong. 2nd. The sale of fir timber and trade. The whole traffic between the upper Tista valley and Tibet is carried on by these people, and they have an extensive traffic in wood for building, which they supply to the treeless regions of Tibet. Twice in the year they cross the Donkia and Kongra Lama passes, and proceed to Kambajong or Jigatzi with their bullocks and yaks, generally laden with timber, less frequently with rice and other tropical products. At the Tibetan marts they exchange these for salt, which, on their return, they again barter with the Sikkim people for rice and other grains. South of Tamlúng the traffic with Tibet takes place by the various eastern passes communicating with Chúmbi, from which place a road, said to be good, leads north-north-east towards Lhasa.

8th to 10th. I halted for three days at Láchúng. Elwes went off to visit the Tankra pass on the second day, but I had been so much punished by the leeches in the hot valleys that I thought it advisable to rest a little. Meantime we purchased a yak from the people, that is to say, the Phipun presented the yak to us, and we presented him in return with sixteen rupees, which was, I believe, rather more than its value. To save time in killing, I shot the yak through the neck, its throat was immediately cut, and in less than three hours it was distributed amongst the coolies, who divided every portion, which could by any possibility be eaten, amongst themselves. At the same time we reduced the ration of rice to half a seer, so that our provisions might last the longer.\* The yak meat was slightly tough, but excellently flavoured.

I occupied myself in collecting for a couple of days. Crows (*Corvus culminatus*) abounded, and there were many red-billed choughs, *Fregilus graculus*, both appearing at a decidedly lower elevation than on the Choló range. In the pine forests were nutcrackers, *Nucifraga hemispila*, numerous tits, *Trochalopteryx affine*,

\* The ration usually given to coolies in Sikkim, one seer of rice per diem, is very large, and from the quantity of carriage required, a great impediment to travelling. It would, I think, be a better plan to give the men only a small load with additional pay and to make them provide their own food.

Ixuli and *Yuhinæ*. *Lanius tephrodornis* was common in the open glades, coming, I think, from beyond the mountains, but I am not certain. However, a few weeks later all had gone down to a lower level. One or two migratory birds were beginning to make their appearance; e. g. *Pratincola indica*, which I first saw on the 9th, and Kestrels.

I could only find one landshell, a *Macrochlamys*, and of that but 3 or 4 specimens, all of which had closed the mouths of their shells with an epiphragm, and, I suppose, had retired for the winter. Indeed the nights were slightly frosty when clear, which they rarely were; usually it rained more or less every day. One morning was very fine, and there was a beautiful view of the snow peaks up the valley and those around the Tankra-lá, on which fresh snow had fallen, but long before midday heavy clouds came up the valley and concealed everything.

Mammals were scarce. There were some bears, and I frequently saw their fresh tracks on the hill sides, where they had torn up the turf to get at roots and grubs. The species was doubtless *Ursus tibetanus*. There were a few goral on the steep hill sides above the houses in which we were living, and serow (*Nemorhædus bubalinus*) in the fir forests, but we only saw the tracks of the latter. A langûr monkey (*Presbytes schistaceus*) was not rare, and two or three were shot by a shikari of Elwes's who had been two months in Láchúng, but had not collected much. We heard of *Ailurus fulgens* but did not see it.

Butterflies were numerous on the grassy banks, and appeared whenever the sun shone, the most conspicuous being *Papilio Machaon*, *Satyrus Padma*, and *Argynnis Issæa*.

September 11th. I determined to go up the valley to Yeomatong and there await Elwes's return from the Tankra. Gúruk had a severe attack of fever, I therefore left him to come on with Elwes. We had discharged several of our coolies, and the useless Nipalese duffadar, and by giving the men meat as part of their rations, we had sufficient rice to last us for about 20 days, after which we hoped to get a fresh supply from the Tísta valley.

A pony was brought for me, on which I rode part of the distance. The roads were much better than in the low regions, but

still the climb over the great moraine just above the fork in the valley was a severe one. All this country has been so admirably described by Hooker that anything I could add from my much shorter visit would be mere recapitulation so far as the scenery and general features are concerned.

After passing the great moraine, the road was much better and more level; patches of the winter's snow were still lying in places in the ravines to the west of the valley, although there was scarcely any on the peaks that were visible. I first noticed larch at about 10,000 feet. My shikari shot a woodpecker, *Picus hyperythrus*, which is very rare in Sikkim, although common in the north-west Himalayas. Wagtails appeared, perhaps coming from beyond the passes, but more probably residents in the Himalayas; I saw one or two *Motacilla* which had not quite lost their summer plumage, and at Yeomatong I found a flock of short-toed larks, *Calandrella brachydactyla*.

Yeomatong is a very pretty place at nearly 12000 feet elevation, with some grand peaks visible when there is not too much mist, but the noble mass which Hooker calls Chang-o-Khang\* was rarely clear whilst I was there. The valley is very straight just here, glaciers descend to within a very short distance, and the whole combination of the deep alpine valley with the crags around, the bluish glacier ice, and the dark pine woods, forms a very striking scene. On the whole I should be inclined to give the preference to this place for beauty, even over Láchúng. There is nothing equal to it in the Láchén valley.

I put up in a good sized house built of fir planks, but it was pervious to the rain from above and the cold winds from the side, and therefore I had the tent pitched as a sleeping apartment on the close velvety turf, which was not swampy here as on the Cholá range. Yeomadong is only inhabited in the spring, summer and autumn; in the winter all the people go down to Láchúng, or, in severe winters, even farther, taking their yaks with them.

\* This name is used by the Láchén people, and, as so frequently happens in mountain regions, it is not that by which the mountain is known on the opposite side in the Láchúng valley. Indeed I could get no definite name for the mountain on this side.

12th. It was clear in the early morning, but, about sunrise, clouds came up the valley, and some rain fell. This cleared off in about an hour, but meantime all the hills around, down to within 1000 feet of the valley, had received a light covering of snow. I started up the east side of the valley about 10 o'clock, and after climbing through firs and rhododendrons for about 2000 feet, emerged amongst grass and rocks; about 1500 feet more took me to the bottom of a small glacier. The giant rhubarb was scattered here and there about the slope, and on my way down I shot one of the grouse-like snow-partridges, *Lerva nivicola*, and an accentor, *A. Nipalensis*. The great glacier which extends nearly to the valley was far beneath me here. At its termination is a peculiar moraine disposed in a terrace. Another glacier which terminates to the northward of the large one, exhibits the same peculiarity in a more striking manner, for lateral moraines, arranged in a double terrace, run for some distance up the side of the valley in which the glacier lies. The cause of the peculiar conformation in the latter case is clear; it is due to the gradual decrease in size of the glacier, and the filling in of the space left between the ice and the sides of the valley by moraines at two successive different elevations at which the ice has stood, but the terrace at the bottom of the great glacier is less easily accounted for.

I had a very slight headache from the climbing, but it soon went off, the men with me suffered more, as indeed they usually did, I think.

13th. A glorious morning. At sunrise there was a little fleecy mist about the peaks, but all above was clear blue sky, and the valley was exposed in all its grandeur. Looking downwards on the west side, a series of crags appeared, of most fantastic shape, terminating in a multitude of pinnacles, here and there set off by the snow which had fallen in the night, and relieved by a few larger snow-covered mountains. Up the valley the huge snow mass of Chang-o-khang rose above all the surrounding peaks, and a big glacier ran down from it which closed the end of one of the forks of the valley. Between the two forks were black rocks with a snowy peak or two rising over them, whilst the eastern slope of the valley was a black mass of fir and rhododendron forest, capped by

sparingly snowed crags and only broken by the huge glacier which descends below all the others, and to which reference has already been made.

I again climbed up the east side of the valley, and shot several snow partridges. On my road up I bagged two blood pheasants (*Ithaginis cruentus*) and I saw some monal, but they were too wary to be shot. On my return I found Elwes who had come from the Tankra-lá; he had been disappointed in his expectations of *Ovis ammon*, but he had obtained several good birds, *Lerva*, *Accentor Nipalensis*, *Fringillauda nemoricola* and *Alsocomus Hodgsoni*, the speckled wood pigeon, which it was rather surprising to find at an elevation of 13000 or 14000 feet. He had, however, unfortunately had a touch of fever the day before.

September 14th. We devoted the day to collecting in the fir woods around the valley. The most common birds were the crested tits, *Lophophanes Beavani*, *L. dichrous* and *L. æmodius*, the first being by far the most abundant. They kept in flocks, and with them were associated many *Phylloscopi* (*P. lugubris*) and *Certhia Nipalensis*. This curious association I noticed in numerous instances; sometimes one or two other little birds were also mixed with the flocks, but the abovenamed species were always together, and I never saw the creeper away from the tits. On the edges of the forest *Ianthia rufilata*, *Tarsiger chrysæus*, and *Trochalopterum affine* were met with, and my shikari brought in the rare *Dryomochares stellatus*. In the open ground *Corydalla striolata* and *Calandrella brachydactyla* abounded, but scarcely any finches appeared. There were several of the red-billed curlew, *Ibidorhynchus Struthiersi*, scattered about the edges of the river; one or two families had probably bred in this spot, as most of those we shot proved to be young birds. Dippers, (*Cinclus Asiaticus*) *Chimarrhornis* and wagtails were common, but no swimming birds, nor any waders except *Ibidorhynchus*. In fact the paucity of water birds, of waders especially, appears characteristic of this part of the Himalayas.

Amongst the moss-covered stones, the Himalayan wren, *Troglodytes Nipalensis*, was common, running in and out of the crevices, and frequently disappearing for some seconds into cavities beneath the rocks. I shot another bird also which for a long time puzzled me,

until at last I found it was *Horeites brunneifrons* of Hodgson. Its actions are singularly wren-like, and I at first thought it must be a *Tesia*, to the neighbourhood of which genus it was also referred by Blyth.

There was a great paucity of Raptores; the common sparrow hawk and kestrels being more frequently seen than any others. Kites (*Milvus govinda*) were common, crows and choughs were abundant as usual. A piping hare or Pika (*Lagomys Roylei*) abounded in the fir forests, but as usual there were very few Mammalia.

September 15th. We marched up the valley to Momay Samdong at above 15000 feet, the highest spot in the Láchúng valley at which there are houses. The road leads through forest for some miles, then ascends over the large moraines at a fork of the valley, where the stream joins from the Chang-o-Khang glacier, and, turning up the eastern fork, rapidly rises above the forest. For 4 or 5 miles more the ascent is very gentle, through rhododendron scrub, but finally all vegetation except grass and very small shrubs is left behind. The eastern slope of the valley is grassy and less precipitous than the western, but on each side, here and there, there are glimpses of snow fields and glaciers upon the heights. We traversed more than one fine ancient moraine stretching partly across the valley; and all the projecting rocks at the sides, with many in the bottom of the glen, were rounded by old glacier action. The rounding is most conspicuous just below Momay, but, although I hunted carefully for it, both here and amongst the blocks of stone in the moraines, I could never detect any polished or striated surfaces, such as are so common in Europe. Hooker has also noticed this, and my friend, Mr. Medlicott, tells me that he could never find any of these fine surface markings in the western Himalayas. I do not know whether the erosion of the surface of rocks, to which the disappearance of glacial scratches is due, should be attributed to their mineral character, or to the climate, but the former differs so little from that of many of the best marked rocks in Europe that I suppose the climate must be credited with the alteration.

The dip of the gneiss foliation in the low Tista valley is very

high, or vertical, and as far as Yeomatong it is still considerable. But at Momay it is very low, and just below the village almost horizontal. In the hills to the westward it dips to the west or southwest at an angle rarely exceeding 10° to 20° . The gneiss is in places granitoid, and often traversed by granite veins; both gneiss and granite consist chiefly of white felspar with but little quartz and black mica.

We selected for our tent a plot of grass in a position sheltered from the wind; our men finding places in some of the houses. There were many people at Momay with their yaks when we arrived, but all left in a day or two afterwards for places lower down the valley.

16th. We heard that a Tibetan officer had come to the Donkia pass, which was about 10 miles away, to meet us, and we arranged to go and see him on the following day. Meantime we resolved to visit the Sibú-lá, the pass which leads from Momay to Phálúng and Tangú in the Láchen valley, in order to see if it was practicable for coolies and if we could cross it in case the Tibetans would not allow us to go over the Donkia-lá. We had scarcely gone a mile when we met a man who told us he had just seen a flock of wild sheep, and a sharp-eyed shikari declared he could see some lying down upon a shoot of stones. Neither Elwes nor I could distinguish them, even with the telescope, but whilst we were watching, 16 burhel (*Ovis nahura*) walked out from amongst the stones, and began feeding in a small plain. Elwes crept in and shot the largest, a young ram. It was about the bulk of an English sheep, but with much longer legs, and proved a grand addition to our larder. We subsequently found that the "*Ovis ammon*" of which we had heard so much were all burhel, and Hooker, I think, must have been mistaken in supposing that he saw the former in this neighbourhood, for, by the unanimous evidence of all the Tibetans, none occur to the south of the Donkia and Kongra Lama passes, although they are to be met with a little farther north in Tibet.

Sending a man back with the burhel, which, I may remark, was the only four-footed game secured by either of us during our trip, we proceeded on our road to the Sibú-lá, passing over the gigantic moraine at the termination of the Kinchinjhaio glacier, and climb-

ing beside another small glacier, partly over grass, but chiefly over piles of stones, many of them loose. At the top was an open barren plateau with some small lakes. I went on till I came to the base of the last ascent; another most difficult pile of loose blocks of stone. It was quite evident that the pass was impracticable for loaded coolies. Here at above 17000 feet I turned back; I felt perfectly well until I did so, but I had a bad headache all the evening from the elevation.

17th. There was a little snow over the whole valley in the morning. We got ponies and started for the Donkia pass. The road led up an open stony valley for 5 or 6 miles, and then ascended rather more rapidly over barren slopes, leaving the Láchúng to the right. We passed flocks of that peculiar bird, *Grandala calicolar*, scattered over the hill sides, and I succeeded in shooting a male in gorgeous blue plumage. We also saw a large lark, probably an *Otocoris*, but it was a cold misty day and a piercing wind swept up the valley, bringing sleet with it, so we had little inclination for ornithology. As we came to the base of the last ascent over a low rocky saddle connecting two higher ridges, all unsnowed, we found the Tibetan encampment, and two officers received us very politely in their tent and offered us the usual buttered tea. After a time there were brought some pieces of cold mutton and flour of roasted corn (*sátú* in Hindustáni) which was eaten by being mixed with buttered tea in each man's cup and made into little balls of dough. We requested that they would allow us to cross the pass and proceed *viâ* Cholámú to the Kongra Lama pass, in the same manner as Hooker and Campbell had been permitted to travel in the reverse direction from Kongra Lama to Donkia. Captain Chamer, to whom I have already referred as having visited these passes a few months before we did, and who was the first who had penetrated so far since Hooker's time, had been told that he might traverse this small portion of the Láchén valley, and he would have done so, but at that time (May) the snow was too deep. We were therefore rather surprised and disgusted at being told that we could not possibly be allowed to go, the Tibetan officers said that especial orders had come from Lhassa, and that their heads

would be cut off, (the assertion was accompanied by a conventional gesture significative of decapitation), if any European crossed the frontier. Expostulation was useless, at every remark, their hands were drawn across their necks to typify their fate if we passed the frontier. At the same time there was no threat of stopping us by force; the people only said "If you choose to go by force we cannot stop you, but all our heads will be cut off." Finally we left them and returned down the valley to Momay. A present of sheep, flour, &c., had been brought for us, but we positively refused to receive anything, as we could only consider people who prevented us from passing a short distance over a tract of country already traversed by our countrymen as enemies.

September 18th and 19th. We remained at Momay endeavouring through Kechú Lama to bribe the Tibetans to allow us to go by Cholamú. At first there seemed every probability of success; we were told that the chief fear of the people was that we should want to penetrate farther into the country. We explained that this was not the case, our sole object was to go by an easy route to the Kongra Lama pass and descend the Láchen. We had examined the Sibú-lá, and found it impassable for coolies, and to go round by Chúngtám was more than a week's journey. But, on the 19th, we heard that a much higher official had arrived at the pass, and we determined to try reasoning once more.

During these two days we had collected several birds. Ravens and choughs (*F. graculus* only, not *Pyrhacorax*) abounded, there were also pipits, short-toed larks, *Chimarrhornis*, a beautiful red-start, *Ruticilla erythrogastra*, and flocks of young birds of *Grandala cælicolor*, of which we never saw a full plumaged male, except near Donkia pass. A day or two after the yaks left, many birds also took their departure. Læmmergeyers appeared occasionally, and amongst the migratory birds were kestrels and hoopoes (*Upupa epops*).

On the 18th there was an inch of snow in the morning over the whole valley, and upon our tent it was still thicker, but we were well protected by the blanket lining, and our people were warmly clad and in good houses. We had to send down the valley for firewood however.

On the 19th I went to the Kinchinjhaog glacier. This remarkable mass of ice absolutely loses itself at its foot under piles of stones, over which I climbed for more than a mile before I came to any ice, and then I only found some exposed beneath a pile of angular blocks of rock in consequence of the surface having fallen in, I suppose from the melting of the ice beneath. It is evident that some of the hills of moraine debris, such as those to the northwest of Momay, have been formed in this manner, at the termination of glaciers.

September 20th. We moved our camp about 5 miles up the Láchúng valley, hoping to be able to cross the Donkia pass next day, and encamped at a fork at nearly 17000 feet, where some yaks had been kept earlier in the year, and an abundance of their dried dung supplied fuel. Elwes, who at first had apparently escaped the effects of the leech bites better than I had, but who had been walking much more than I, now found himself rather lame from their effects, and he therefore remained behind at our new camp whilst I rode up to the Donkia pass again. I found the tents of the Tibetans still closer to the crest of the pass than before, indeed they were not more than 200 feet below the top, on the Sikkim side. I was received by an officer in a yellow silk dress, and wearing a conical Chinese hat, capped by a white glass button, the mark of his rank. This was Soná-wándje, the Súbá or governor of Kambajong, and by far the best specimen of a Tibetan gentleman whom we met. He was very polite, but perfectly firm on the point of giving us no permission to cross the frontier; he produced letters which he said had been sent to him from Chúmbi, Jigatzi and Lhassa, ordering him on no account to permit us to enter Tibetan territory.\* An enquiry as to how information of our journey had been received elicited the fact that it had come from Chúmbi, and coupling this with a previous remark of the Súbá's that he had recently received a letter from the governor of that province requesting him to shew us every attention, it appeared to me high-

\* I am inclined to believe that orders had really arrived to stop us. The Tibetans had heard that one European had visited the passes in the spring, and that two others were on their way to them, and so unusual a visitation, in a place in which no white man had been seen for more than 20 years, had alarmed the celestials.

ly probable that this stubborn opposition to our traversing a small uninhabited valley was due to Hooker's old enemy the ex-Dewan of Sikkim; now governor of Chumbi, as I have already mentioned. I, of course, pleaded that there could be no objection to our going where Hooker and Campbell had been before us, but the Súbá replied that the Dingpan who allowed them to pass had been beheaded and his property forfeited.

This story I had never heard before, and I fully believe it to have been invented, indeed I expressed myself unable to put faith in it. It is simply incredible that it should never have been told to us at Chumanáko, when we enquired as to our being permitted to cross the Donkia pass, that no such story should ever have been heard by any previous traveller in Sikkim, and that no rumour of such an occurrence should have penetrated to Darjiling; above all that Captain Chamer should have been allowed to cross Kongra Lama only a few months before our arrival.

But although I doubt whether my friend the Súbá was quite truthful in this matter, it was impossible to be insensible to his politeness. He said he wished very much that no European travellers would come to the Sikkim frontier, for he had just obtained leave of absence and started for a visit to see his relations whom he had not met for years, when he was suddenly ordered back to the frontier to stop us from passing. Indeed it was no sinecure to be perched up on a bleak barren mountain pass at upwards of 18000 feet elevation for several days.

After a long conversation, I expressed a wish to see the view from the pass, but even this was opposed, and I was assured, with the usual pantomime of decapitation, that the Súbá dared not allow me even to look upon Tibet. As I knew this was absurd, the only effect was to make me disbelieve every word I had been told previously. I insisted upon seeing the pass at any rate, promising not to go beyond the chait which marks the frontier, and no further opposition was made. It is not easy to climb a steep path at 18500 feet, and we all made several halts in ascending the short distance which separated us from the crest of the mountain. All on the side by which we ascended was mist, but on the other side it was clear, the only impediment to sight being the clouds which were blown up from behind us.

The scene that bursts upon the eye from the crest of Donkia is one of those which can neither be described nor represented. Cholamú lake is in front beneath the feet of the spectator, beyond is a desert with rounded hills. Farther away range after range of mountains, some of them covered with snow, extend to a distance which the eye cannot appreciate. The total change of colour and form from the valleys of Sikkim, the utter barrenness, the intense clearness of the atmosphere produce such an effect as if one were gazing upon another world in which the order of this is no longer preserved; where a tropical desert is seen amongst snow-capped peaks, beneath the unnaturally clear atmosphere of the arctic regions.

Hooker's description, Vol. II, pp. 123-128, and the view in Pl. VIII, of his *Himalayan Journals*, (larger edition,) give a faint idea of a scene which it is beyond the powers of either art or language to convey faithfully. It is doubtless one of the most remarkable landscapes in the world, and alone worth the journey from Darjiling in order to see it.

I rode back in the afternoon rather disgusted at the prospect of not crossing the pass; not only did I wish to see something more of the Tibetan plain, but the fauna, as described by Hooker, is peculiar and quite different from that of the neighbouring valleys in Sikkim. I especially wished also to see the fossiliferous limestone which Hooker noted, and which, singularly enough, appears just beyond the Tibetan frontier.

On arriving at our camp I found Elwes had not returned, nor did he do so until half past 7 o'clock, an hour after dark. He had strolled out up the side valley which branches off from the Láchúng to the west close to our camp, and leads to a little known pass called Sàng-lá, two or three miles west of Donkia pass. He had gone out without any intention of doing more than looking at the valley; indeed, being rather lame from leech bites, he had stayed behind in order to rest, but he found himself so close to the frontier that he went on to the top of the pass, and then, seeing Cholamú lake beneath him, and no Tibetan in sight, the temptation to go on was irresistible and he descended to the lake, partly by a snow slope, partly over a shoot of stones. There he could find no one;

he had expected to meet with the Tibetan encampment, but that was high upon Donkia, so after firing 3 or 4 shots, of which no one took any notice, he was obliged to climb back by Donkia Pass and to astonish the Tibetans by appearing from the north.

September 21st. A bitterly cold morning, hard frost and a little snow. The coolies had esconced themselves amongst the stones in an extraordinary manner, and contrived some kind of shelter, but they chiefly kept warm, I fancy, by huddling together. We called all the men together and sounded them as to whether they, or any part of them, would follow us if we forced our way across the pass. The Tibetans had no arms, and had evidently no intention to use violence, and we could either give them the slip, or push past them. But all, Nipalese and Bútias, alike refused to follow, alleging that the Tibetans would be revenged upon them at some future time. There was no help but to return, and ascend the Láchén to Kongra Lama.\*

Meantime the Súbá of Kámbajong and his men arrived from the frontier, very indignant at what they considered the trick played upon them the day before, for they very naturally concluded that the story I had told them of Elwes being lame was false, and that I had occupied their attention whilst he slipped over the frontier. They were especially angry with Kechú Lama, who had accompanied me. I may add that I believe the indignation was in part assumed, as they all declared that their heads would be cut off, which I took and still take the liberty of disbelieving; their main object being throughout to induce us, by all means in their power, not to attempt to cross the frontier. After a little conversation we persuaded the Súbá that Elwes had only gone from one pass to the other, and pacified him, the more so that, seeing it was hopeless, we promised

\* I should say here, lest it be thought that, in attempting to cross the frontier by pushing past the guard, or giving them the slip, we risked either bloodshed, or the severe punishment, by their own government, of men who had treated us with civility, that I firmly believe both fears were utterly groundless. The Tibetans guard their frontier from the entrance of Europeans because it is the traditional custom, and because the Chinese government orders it. Dozens of sportsmen have crossed at one time or another into western Tibet, but no ill results have ever been heard of. Had we crossed, I believe that the Súbá and his guard, after bewailing their imaginary fate for a reasonable length of time, say an hour or two, would have marched on with us in the most friendly manner to Kongra Lama.

not to enter Tibet, but to go to the Láchén valley by Chúnghám; we finally parted promising to meet again in a few days at Kongra Lama. We offered the Súba some cloth and a few other small presents, but he assured us that he could not receive anything, as it was not allowed by the Tibetan government. A map of the Tibet frontier and a photograph of Elwes he would apply for permission to accept when he met us at Kongra Lama. After the interview was over we marched back to Momay.

22nd. We had a lovely morning, and all the peaks, Kinchinjha and the Matterhorn-like Donkia included, were free from mist. We started down the valley, Elwes, who had over-exerted himself in crossing two passes above 18000 feet in one afternoon, and who was consequently very lame, on horseback. On our stopping to breakfast about half way to Yeomatong, I was surprised to see the Láchúng Phipan, who was with us, produce a good sized piece of raw mutton, about half a pound in weight, and proceed to eat it without either cooking or sauce, or any addition whatever. I have often seen dried meat eaten raw, but I had supposed that a taste for fresh uncooked meat was peculiar to the people of Abyssinia. It was rather amusing to note that our friend, the Phipan, imitated the Abyssinians not only in the material for his meal, but also in his mode of eating it: siezing the end of the meat in his teeth and cutting off pieces by an upward sweep of his knife. It only required the curved Abyssinian scimitar to have completed the resemblance.

When two or three miles from Yeomatong, I rambled into the forest, and came suddenly upon a flock of blood pheasants in a mossy hollow amongst the fir trees; I shot one or two on the spot, and following up the others, which were far from wild, I killed 5 altogether.

September 23rd and 24th. Elwes was so lame that we halted for a couple of days, and I collected several birds, the most interesting being a specimen of that rare buzzard, Hodgson's *Buteo plumipes*, which was brought in by a shikari. The weather was not very fine. On the second day I visited the hot spring below Yeomatong on the banks of the Láchúng, described by Hooker, Vol. II, p. 116. The road to it, along the river banks, was one of the very worst I ever traversed, even in Sikkim.

Some migratory birds which we had not met with at first now made their appearance, amongst them *Ruticilla rufiventris*, *Pratincola Indica*, and *Pipastes maculatus*.

September 25th. We returned to Láchúng through mist and rain, and re-established ourselves in the house east of the river. On the road I saw some *Ceriornis*, and shot a hen, but the cock again got off. I had no luck with pheasants.

26th to 28th. Elwes being still too lame to walk, we were compelled to halt. His leg was so queer at one time that it became a question whether he should not rig up a dhúli or "man-chil,"\* and make the best of his way to Darjiling. But at length he was sufficiently recovered to march.

Meantime I had rambled about the neighbourhood and shot a few good birds, the best being some small Sylviads, *Reguloides*, *Phylloscopi*, *Abrornis*, &c., and a rare long-tailed tit, *Ægithaliscus iouschistus*. I also obtained some nutcrakers, *Nucifraga hemispila*, and several Leiotrichians, such as *Minla ignotincta*, *Siva strigula*, and *Yuhina occipitalis*. *Lanius tephrodornis*, which was abundant a fortnight before, had departed, and the higher hills were becoming richly coloured with autumnal reds and browns.

On the 27th, some of our men took a bees' nest hanging from the rocks, and we obtained a large supply of honey. Curiously enough, although the honey had no effect upon me nor on any of the servants, a very small quantity made Elwes ill. It is notorious that honey in Sikkim is sometimes poisonous, Hooker mentions this, (Vol. I, p. 201,) and all the natives are acquainted with the fact, but in this instance only one out of a large party was affected by it.

29th. We got away at last, and marched rapidly down the valley. At Kadam, which we reached about midday, we found quantities of ripe peaches, they were, however, very inferior and tasteless. The marwa was fast ripening on the flats around the village. We did not halt here, but went on to Chúngtám, and put up in the monastery, instead of the little hut where we had previously slept. The monastery is at the base of the hill between the Láchén and Láchúng and overlooks the junction of the two

\* A litter slung to a bamboo as used in Canara and Malabar.

rivers. The weather had greatly improved since we had been in the Láchúng valley.

30th. Men had been sent to repair the road, which is never traversed in the monsoon between Chúngtám and Lámteng, the village in the Láchen valley corresponding to Láchúng. We started up the Láchen valley on our way once more to the Tibetan frontier. We seemed at last to have a spell of really fine weather, and our only regret was to lose such a day in the bottom of the hot Láchen valley. However, we escaped leeches to some extent in consequence, and certainly not because of their paucity. The path soon crossed the Láchen by a cane bridge, and then led over steep banks, climbed by means of bamboo ladders and poles with notches cut in them. Afterwards the road led for miles through marshy flats. The east bank is for some distance rocky and grassy, the west alone being wooded, but forest afterwards appears on both slopes, which do not rise abruptly to nearly so great a height as in the Láchúng valley. The marks of glacial action also are much less distinct, although smoothed and rounded rocks appear here and there. About four o'clock, after a tedious march, we reached Láton, where several dirty houses, uninhabited at this season, were nearly buried in thickets of shrubs. One house was the only place we could find habitable, and this was detestably filthy, whilst there was no place to pitch the tent. All the hills just above us were covered with pine trees.

October 1st. The road up the valley was very much like that of the day before, execrably bad in places, traversing precipices by means of bamboos and notched poles. The bridges, however, had been repaired. We twice crossed the Láchen by cane bridges. The greater part of the route lay through dwarf bamboo underwood, in which leeches were numerous, despite the fineness of the day. At length we came upon pine trees and left the blood-thirsty Annelides behind. The road crossed two gigantic moraines, parts of which were open and covered with grass, and beyond the second we came in sight of a very pretty reach of the valley, looking up to the Zemú fork and presenting an exquisite landscape, although inferior in grandeur to the Láchúng at the same elevation. Turning round a corner we came suddenly upon Lámteng, a large village,

with the houses near each other, and all supported on piles as at Láchúng. We put up in one of them. The village is at a rather higher elevation than Láchúng,\* and the pine trees, (*Abies Smithiana*) descend about 500 feet below it.

On the road I obtained *Proparus chrysæus* and one or two other good birds.

October 2nd. The weather was still magnificent, and the road, though still steep, a great improvement on that of the day before. Indeed after crossing the Zemu, (where we stopped to breakfast, and I shot a *Picus hyperythrus*,) and ascending the opposite bank, the road was quite practicable on horseback. The communications of the people of the Láchén valley with Sikkim are evidently much more restricted than are those of the inhabitants of Láchúng, but the former, like the latter, carry on a considerable trade with Tibet, the road by Kongra Lama being easier than that by the Donkia pass.

The forest after passing the Zemú is mostly small; junipers abound and are finer than in the Láchúng valley. About 4 o'clock, after a long march, we reached Tallam Samdong, a large village of stone houses, one of the best of which had been prepared for us. We had a number of clean fir boards laid down and made ourselves comfortable.

3rd. The morning was spent in a vain search after a flock of wild sheep on the opposite slope of the valley. We ascended about 1500 feet amongst shrubs with rich autumnal tints, but although tracks were numerous, no sheep could be found. On the road down, we shot a number of snow pigeons, *Columba leuconota*, which are more abundant here than at any other place I have seen in Sikkim, and on which Hooker lived to a great extent when the Dewan and the Súbá of Singtám tried to starve him out of the country. There were a few choughs and crows, but no ravens.

After breakfast we obtained some pretty good ponies and rode to Tangú, a very short march, of not more than 6 or 7 miles, by a very tolerable road for Sikkim. At Tangú were many people with their yaks, the elevation, 12,750 feet, being only a thousand feet

\* 8,900 feet above the sea, according to Hooker.

above Yeomatong. The houses were small and all occupied, but two of the usual black blanket tents had been pitched for us, and we used these in the day, sleeping in our own. We purchased a yak from the people and slaughtered it. At night the other yaks, scenting the blood, came at a gallop past our tent, bellowing and grunting, and a singular scene took place in the moonlight. The smell of the blood appeared to excite them, they rolled in it, fought with each other and rushed wildly about the place. I was afraid they would knock our tent down, but they avoided it.

4th. I remained in camp in the early morning, but after breakfast, about 10 o'clock, we started on horseback for the frontier. The day was fine, but there was a little mist, which increased towards the afternoon. We went up the Láchén valley, not by the alternative route *viâ* Phálúng, and ascended over the huge moraine which crosses the valley just above Tangú; a little beyond this we were above the limit of trees, and then the road led for miles through the open valley with grassy slopes on each side. About 7 miles from Tangú we came in sight of a flock of burhel after which Elwes went, but without success. Above this the valley became more and more barren, its bottom consisting of moraines alternating with stony flats. I shot a Cashmir dipper, *Cinclus Cashmiriensis*, in the river, and saw the other Himalayan species *C. asiaticus*, and between us we procured *Ruticilla erythrogastra*, *Accentor rubeculoides*, a horned lark, *Otocoris*, of a species not previously known, and *Leucosticte hamatopygia*, only known before from Western Tibet.

My pony being very slow, I did not arrive till some time after Elwes. I found the Súbá's tents pitched under the shelter of some rocks close to the frontier, which is a bleak open plain where the valley is broader than usual. Our friend the Kámajong Súbá was beaming with politeness and good nature. He had brought us as a present three perfectly fresh skins, one of *Gazella (Procapra) picticauda*, the others of *Ovis ammon*, an ewe and a young ram, to obtain which he had sent out a shikari. He had also four live and healthy Tibetan sand-grouse, *Syrrhaptes Tibetanus*, which he begged us not to kill if he gave them to us.\* Like a true

\* With much trouble we succeeded in bringing these alive to Darjiling, where

Buddhist, he mourned greatly over the sin we committed in shooting birds, though he admitted having once been a sportsman himself, and having actually bagged two wild yaks, rather an achievement.

We spent a most agreeable evening with the Súbá, who is a very gentlemanly, well informed man. He examined our guns, and the few books and similar small matters which we had with us. He accepted the map, after writing the names of the places, and of the marches to Darjiling, on it in Tibetan, and he also took a photograph of Elwes, saying that he had received permission to accept these, but he would take nothing else. He was very curious about Europeans, we being the first he had ever seen, and especially wished to know what English ladies were like. At the same time he begged us not to form our judgment of Tibetan beauty by the specimens to be seen on the mountains.

We had a long conversation, through an interpreter of course, about Tibet. The Súbá had travelled much, having been at one time in Ladák. I was particularly anxious to learn whether the Tibetans as a body are unfriendly to Europeans, or whether the sole hindrance to entering the country is the jealousy of the Government. The Súbá assured me that the people had no ill-will towards foreigners, that, if allowed, they would willingly receive Europeans, and he regretted that he was obliged to carry out the orders he had received. Otherwise he would have had great pleasure in receiving us at Kambajong.

All that we learned as to the geography of the country north of the Sikkim frontier confirms Hooker's account, even to the digging of the salt at the lakes whence a great part of Tibet, Sikkim and Nipal, are supplied. The salt country lies a long distance north of Jigatzi, and is described as a dreadful wilderness in which no one can live for any time. We were even told that the people who procure the salt rush in, dig up a small quantity and run back, or they would fall insensible. Fearful wild animals and the horniest and hairiest of demons guard the frozen soil. All of which means simply that the country is bitterly cold and barren,

however, one died, and a second did not survive the road down to the plains. I brought two to Calcutta, apparently in perfect health, in October, but before I could despatch them to England; both died of inflammation of the lungs.

and that the powers of the imagination are still vivid at elevations of 14000 to 18000 feet above the sea.

Whilst we were conversing a post arrived with some orders for the Súbá. He said they related to an officer who had come from Pekin to visit the frontiers. This led to a conversation about communication with China and we learned that it takes a year to reach Pekin from Jigatzi. We suggested that a very much shorter time would suffice for communication through India. It appears that the direct road to China is not used in consequence of orders from the Chinese government, which is, I imagine, a Chinese mode of expressing the fact that the road is in the hands of insurgents, and that the only available route is one to the northward, perhaps that by which M. M. Huc and Gabet penetrated to Lhasa. Our statement that British and French troops had once held Pekin was treated as a joke, and the Súbá suggested that perhaps our Government had proclaimed the event, but that nothing of the kind had ever taken place.

About the trade on the frontier we could learn but little: a small quantity of hardware, and small objects, such as spectacles, small looking glasses and similar articles are brought into the country by pedlars. The import of tea is prohibited; this, which we had learned on the Cholá range, was confirmed at the northern passes. It is greatly to be regretted, because a tea-drinking nation like the Tibetans might be much better and more cheaply supplied from Sikkim than from China.

Of the wild animals, both *Ovis ammon* and *Ovis nahura* are pretty common in the country north of Sikkim. The Goa Antelope, *Gazella picticauda*, is less so. The Súbá expressed his surprise at Hooker having seen Chiru (*Kemas Hodgsoni*) at Cholámú lake, and said he had never heard of any in that neighbourhood. The wild yak is not found in this part of Tibet. The Súbá had an overcoat lined with the fur of an ounce (*Felis uncia*, the snow leopard of the Western Himalayas), but he said the animal was not common.

October 5th. The night was bitterly cold, and in the morning the ground was covered with hoar frost, and all the little marshes frozen, whilst a keen north wind was blowing. We visited the chait

at the frontier,\* and found a guard sleeping around it, with walls of loose stones built up to protect them from the wind. An attempt was made by our head man and the Lama to induce us to salaam to the chait, which is considered sacred, and moreover is a representative of the rulers of Sikkim and Tibet, as it contains a board with their seals impressed on it, one on each side. However, on our objecting that it was not our custom, the matter was not pressed.

There was no view across the frontier. Barren rounded hills closed the landscape at a short distance. Barren and uninviting as they were, I would have given much for a few hours upon them. But we had promised not to cross the frontier and I could only ramble about on the Sikkim side. I walked back towards Tangú very leisurely, Elwes going by Phálúng. I shot a number of *Leucosticte* and two birds of an apparently undescribed finch, which I at first took for a snow bunting, but it is, I believe, a new *Montifringilla*. I saw a couple of slate coloured hares, but failed to secure either, whilst Elwes picked up a fine fox's brush. I also, on this occasion, came across the yellow billed alpine chough, which is far rarer than the red billed bird in Sikkim.

Thus, in the upper Láchén valley we met with a lark, 2 finches, an *Accentor*, and a chough which we had not previously obtained, and had we had more time, the list might probably have been increased. Læmmergeyers were abundant, but again I failed in obtaining a specimen. The fauna in this valley is more thoroughly Tibetan in the upper part than is that of the Láchúng.

The morning was fine, but about midday mist was blown up the valley, and a little rain fell. I did not reach camp till late in the afternoon. The Tibetan Súbá had accompanied us, on the plea of having business to transact with the Láchén Phipan in Tangú, but really, I believe, from fear that we should in some way give him the slip and cross the frontier.

6th. We halted at Tangú, and were busily engaged all day in skinning, and preserving the *Ovis ammon* skins. I had intended to go to Phálúng, but the weather was vile, misty and wet. The

\* The name of this place is Djokongtong. Kongra Lama is, I think, the name used by the people of Sikkim proper, not by those of the Láchén valley.

Súbá passed much of the day with us, looking over books, &c. He was greatly disgusted at our bird collecting, but told us that so long as Kechú Lámá remained with us, the presence of so holy a man might protect us. Evidently he wished us to infer that to go on in our wicked ways after the Lámá left would entail our certain destruction. I am inclined to believe that any one trying to enter Tibet will find it much easier to do so if he carefully abstain from shooting and from taking life in any form. The mere eating of meat will not injure him; when we taxed the Súbá with having animals killed for food, he replied that he only eat very little meat, and that, after it had been killed at least three days.

The curious idea about heavy rain being caused by shooting, to which Hooker alludes, is universal in Sikkim, and we were several times told that if we wished for fine weather, we should not shoot.

Our friend greatly coveted one thing, a rather nice pair of binoculars which I had with me, but nothing would induce him to accept them. As we did not like to leave this worthy Tibetan without some return for his kindness, Elwes at length, after I had left, again offered him the binoculars, and finally exchanged them for a handsome set of Chinese or Tibetan table utensils, *viz.*, a long knife, and a set of chopsticks in a shagreen case: the Súbá had begged to be allowed to purchase the glasses, which, of course, we would not allow.

Of four sheep which the Tibetans had given to us, one died and two others were sickly, having been poisoned, our people said by a shrub with a yellow flower, which grew in abundance in the neighbourhood. Hooker attributed similar accidents at the same place to a rhododendron, (*R. cinnabarinum*). Our coolies ate all the sheep, including the one which had died.

October 7th. Elwes went down to Tallam Samdong with the camp. As the march was a short one and the day fine, I determined on riding to Phálung first, in order to see the plain described by Hooker. The road led north-north-east up the valley of the Tangú-chú for 5 or 6 miles, rapidly ascending above trees and then more gradually over grassy slopes. I saw a herd of burhel, but, as I had no rifle, I did not go after them. After about 2 hours ride I came upon the undulating expanse of grass at about 16000

feet. The little plateau, 2 miles by 4, according to Hooker, (and I have no doubt his measurements are correct) is not only, as he says, covered with transported blocks, but the whole mass is composed of moraine, not a rock is to be seen in place throughout! The marshy bed of the Cháchú, in the valley which runs along the eastern side of the plateau, quite agrees with Hooker's description of it as an old lake bed, the terminal moraine to which the lake was due still existing. I climbed down to this valley and satisfied myself that the slope of the plateau from top to bottom, 500 feet at least, consists of loose stones and angular gravel, the usual moraine debris.

It is not easy to account for so enormous an accumulation of moraine as that of Phálúng from the little valley of the Cháchú, for if the Phálúng plain and a corresponding moraine of smaller dimensions, which is seen east of the Cháchú, on the flanks of the Chang-o-Khang spurs, are the lateral deposits from the glacier which formerly filled the Cháchú valley, how it is possible to account for the comparatively small size of the terminal moraine which dams up the old lake bed. That such an accumulation as the Phálúng plains can be formed at the termination of a large glacier is seen at the end of the great Kinchinjhaó glacier near Momay Sámdong, but then this difficulty arises: suppose that glaciers from Kinchinjhaó and Chang-o-Khang deposited this mass of debris, there must have been an increase in the length of the Cháchú glacier in order to cut out again the lake bed in which it now runs. But the glacier, when it deposited the Phálúng moraines, must have filled the whole valley, including the portion now occupied by the moraines themselves, and therefore the glacier when longer was smaller than when shorter, a palpable *reductio ad absurdum*.

I am inclined to suspect that these moraine deposits of Phálúng must have come from the Láchen valley at a time when the high Tibetan table-land to the north was a mass of snow, and a large glacier passed off between Kinchinjhaó and Chomiomo, and down the Láchen valley; the same great glacier which left its terminal moraines near Lámteng, at Tangú, and in a dozen intermediate spots, as it slowly diminished in size, and even more gigantic records of which than any now existing may have been swept down the Tista valley by the heavy Sikkim rainfall and the

torrents to which it gives rise. Such a great glacier, after turning round the steep lofty flank of Kinchinjha, must have been far higher than the low hills which separate Phálung from the present Láchen valley and a branch of the glacier descending into the Cháchú valley may easily have filled it with a mass of debris which the little Cháchú glacier was unable to sweep away.\*

I had hoped to find some of the Himalayan snow cocks *Tetraogallus Tibetanus*, which Captain Chamer shot at Phálung, but there were none at this season. The natives, who know them well, say that the birds keep at a higher elevation in the summer and autumn. I found short-toed larks abundant, and I came across one flock of the small *Montifringilla* killed at Kongra Lama, and *Accentor rubeculoides*. At the Cháchú, to my surprise, not a duck nor wader was to be seen; although the valley looked peculiarly fitted for them, being a series of small marshes with deepish serpentine streams running through it.

The view of Kinchinjha was partly concealed by mist till just as I was leaving, when a snow storm came on, preceded by a little lightning: as the storm cleared away, all the peaks came out grandly. The panorama around Phálung well deserves Hooker's praise. In the afternoon I rode down to Tállam Sám-dong.

October 8th to 14th. We started the next morning from Tállam Sám-dong. The morning was superb, the hog-backed white summit of Chomiomo, closing the view up the Láchen valley, was as distinct as if only a mile distant. Our return march demands but brief description. We reached Lámteng on the 8th, a spot in the bed of the river below Látong, on the 9th, and the monastery at Chúngtám, on the 10th. Thence 4 days' march brought us back to Tamlung. The weather had become fine, with the exception of a few occasional showers, and the leeches were fewer in number than when we marched up the Tísta valley. In fact we had arrived at the best season for entering Sikkim instead of leaving it.

\* Mr. Jamieson has suggested, *Quart. Journ. Geol. Soc.* 1863, Vol. XIX, p. 258, the formation of somewhat similar deposits in lakes dammed up by glaciers. Dr. Hooker, at an earlier period, *Him. Journ.* Vol. II., p. 119, referred the terraces at Momay to the same cause. Both the accumulations at Phálung, however, and those at Momay appeared to me too irregular to have been deposited in water. At Phálung there is certainly no trace of terrace formation.

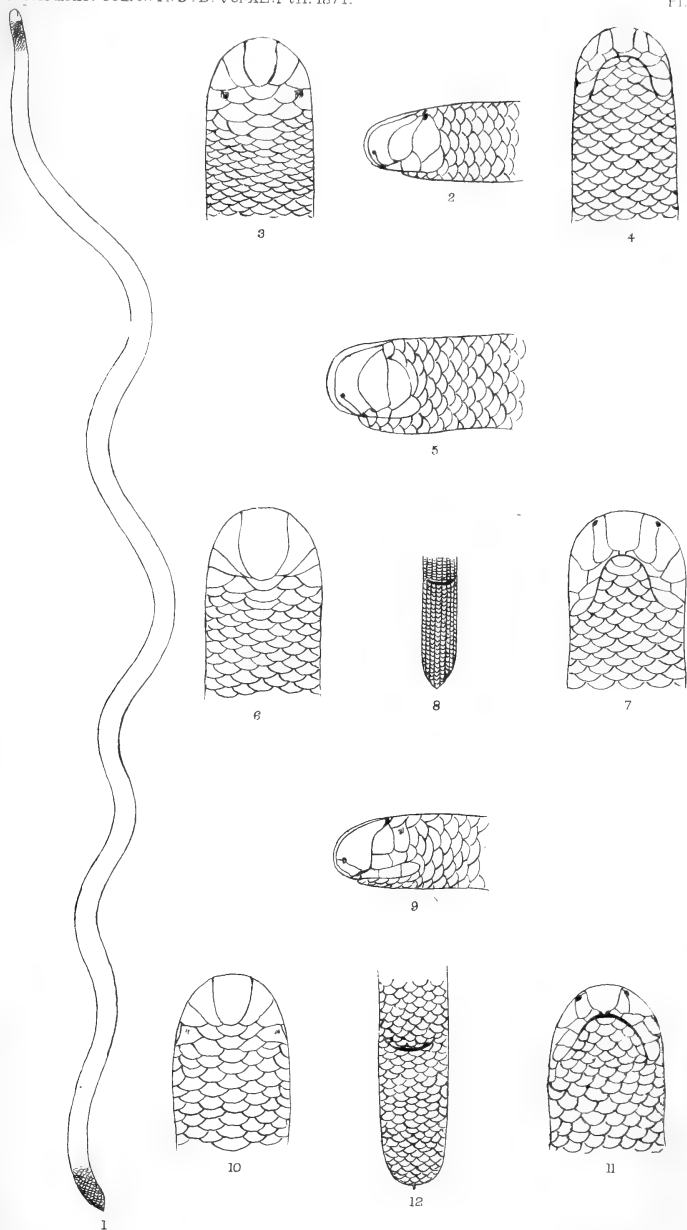
The heat in the valleys was no longer great, except in the middle of the day.

15th to 20th. On the 15th, we parted from Kechú Lámá who returned to Chúmby from Tamlúng. By him we sent a letter to the Rájá thanking him for the assistance his people had afforded us. I have omitted to mention that when we were in the Láchúng valley, we on several occasions received presents of goats, sheep or flour from Chúmby, and once a yak was brought to us from the Rájá.

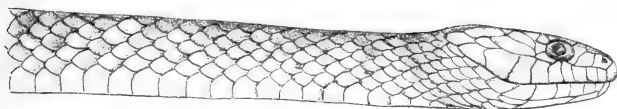
We made a longish march from Tamlúng to Selingtám, crossing the Ryot valley, and ascending the opposite side. Here we came on traces of the military road made to Tamlúng in 1863, and the less steep portions of which are still in good order. On the 16th we crossed the Tísta by a very long cane bridge in a poor state of repair, and, after ascending the slope a little way, camped at Lingmo. On the 17th we marched down the Tísta valley to Tarco on the northern flank of Mount Tendong, a village standing amongst orange groves, now loaded with fruit, and on the following day we crossed Tendong by a road which goes over the top of the mountain and descended to Námchi, opposite Darjiling.

The change in the fauna in coming southwards is very marked, the number of forms increases, and there is a far greater prevalence of Malay types on the outer hills as compared with the upper Tísta valley. The weather was now generally bright and clear, and the roads in good order. Finally, on the 19th, we walked down to the Rungit, and, mounted on horses a friend had sent down for us, rode back into Darjiling and the nineteenth century.

Although we had been disappointed in our attempts to enter Tibet, we had been able to add something to the known geography of Eastern Sikkim. We had explored one pass, and ascertained the position of a second, never previously visited by Europeans nor laid down in any map. We had met with 3 lakes of considerable size, all equally unmapped, and apparently larger than any previously known to exist in Sikkim, and we had obtained a considerable number of birds not before recorded from this part of the Himalayas.



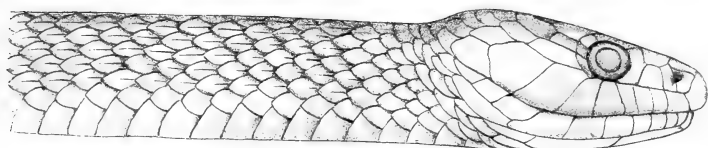
1-4. *Typhlops porrectus*. n. sp. 5-8. *T. Theobaldianus*. n. sp.
9-12. *T. Andamanensis*. n. sp.



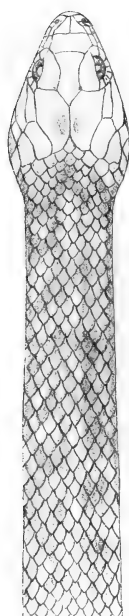
1



2



3



1a



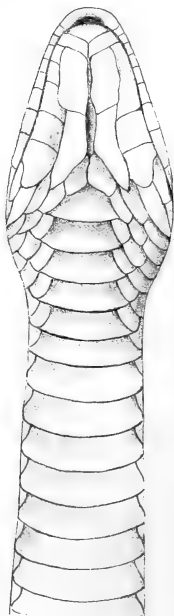
2a.



2b.



3a.



3b.

1. *Tropidonotus quincunciatus*. var.
2. *Trop. bellulus* n. sp. 3. *Trop. subminiatus*.

NOTES ON SOME INDIAN AND BURMESE OPHIDIANS,—
by DR. F. STOLICZKA.

(With Plates XXV and XXVI).

[Received 22nd August, read 6th September, 1871.]

The following notes have for their object the recording of some observations which I lately had the opportunity of making on some Ophidians, partly from India, partly from Burma. These observations refer not only to certain variations in the characters of the species themselves, or to their identification with others, but are also intended to afford some additional information regarding the geographical distribution of the various forms.

Most of the snakes which I am about to notice belong to the TYPHLOPIDÆ, COLUBRIDÆ and DIPSADIDÆ. Under the first family, I shall note variations of different species of *Typhlops*, and shall describe three new ones. In the COLUBRIDÆ the identification of Blyth's *Tropidonotus macrops* with Günther's *Tropidonotus macrophthalmus* is important. From Burma I have to record a new species of *Tropidonotus*, apparently distinct from *quincunctiatus*. A description of *Trimeresurus Andersoni* is also added, because the distinctness of that species has lately been questioned.

For the materials, noticed in the present paper, I am greatly indebted to Dr. Day who obtained specimens for me from the North-West Provinces, to Mr. Wood-Mason, Mr. A. Lawder at Almorah, to Mr. Mandeli who kindly collected for me in the Rangnu and Tista valleys in Sikkim, to Mr. M. R. Martin at Pankabaree, and to Mr. Kurz, who brought me some interesting species from Burma. Some species were also collected by myself in the neighbourhood of Calcutta, others at the Parisnáth hill in W. Bengal, others in the neighbourhood of Darjeeling.

Trustworthy notices regarding the geographical distribution of Indian and Burmese snakes are very much needed, and this is particularly the case with those species inhabiting the southern slopes of the Himalayas. A number of unreliable data as to the occurrence of certain low-land and tropical forms at elevations of from 9000 to 12000 feet, or even in Tibet and Ladak, have crept into Indian Zoology, chiefly through the occasional vague records of the

Messrs. Schlagintweit, and other collectors, and these apparently authenticated statements have given rise among European Zoologists to all kinds of strange ideas, either about the adaptitude of the Himalayas to different faunas, or about the plasticity of the organization of certain species enabling them to inhabit very different elevations and climates. There is, in reality, no foundation for such ideas, and the sooner these wrong notions and interpretations are dissipated, the better will our fauna be understood, as well as the physical character of the Himalayas themselves. Tropical and subtropical forms often occur in the Himalayas far in the interior, and in very close proximity, but they are always confined to the deep, warm and damp, valleys, while at the greater elevations of the neighbouring ranges an altogether different fauna exists. Thus, although frequent reference is made to one place as the locality of a species, this may really refer to an entirely different division of the fauna, and this is what constitutes the great peculiarity of the Himalayas regarding the distribution of animal and vegetable life, and the difficulty of understanding it, as I have pointed out (in Journ. Asiat. Soc. Bengal, 1868, vol. xxxvii, p. 4 et seq.) with reference to the Sutlej valley.

As a particular instance in illustration of these remarks, I give the following list of species of snakes which were obtained by Mr. Mandeli, or by myself, in the Rangnu and Tista valleys below and S. E. of Darjiling, mostly at elevations varying from 1500 to 3000 feet. They are—

Typhlops Horsfieldi, (rare); *T. braminus*, (common); *T. porrectus*, (n. sp., rare); *Trachiscium fuscum*, (common); *Ablabes collaris* and *Rappii*, (common); *Simotes punctulatus*, var. α , β and γ , apud Günther, (common); *S. bicatenatus* (not common); *Zaocys nigromarginatus*, (rare); *Compsosoma reticulare*, (not common); *Comps. radiatum*, (common); *Comps. Hodgsoni*, (rare); *Coluber porphyraceus*, (common); *Tropidonotus subminiatus*, (common); *T. quincunctiatus*, (common); *T. macrops*, (not common); *T. junceus*, (rare); *T. Himalayanus*, (rare); *T. platyceps*, (common); *Dendrophis picta*, (common); *Chrysopelea ornata*, (not common); *Tragops prasinus*, (common); *Passerita mycterizans*, (not common); *Psammodynastes pulverulentus*, (rare); *Pareas monticola*,\* (rare); *Dipsas bubalina*,

\* Günther I. R., p. 327. In a specimen no labials enter the orbit, a small

(very rare); *D. Forsteni*, (very rare); *D. hexagonotus*, (common); *Lycodon aulicus*, (not common); *Lyc. jara*, (rare); *Bungarus cæruleus* var. *a*, (not common), *Naja tripudians*, (not common) and *Ophiophagus elaps*, (not common), the former growing in the Terai up to 6 feet, and the latter attaining occasionally 12 feet in length; *Trimeresurus gramineus*, *carinatus* and *monticola* (none, except the last, common).

Now of all these species, for most of which the locality 'Darjiling' (8000 or 9000 feet) has already been recorded, not a dozen will be met with at that place itself, or even at elevations above 6000 feet. Within 1000 or 2000 feet of Darjiling I only observed *Trach. fuscum*, *Abl. collaris*, *Comps. Hodgsoni*, *Trop. subminiatus*, *junceus*, *platyceps* and, I think, *Himalayanus*, *Trim. monticola*, *Bungarus* and *Naja*, the two latter evidently following up food. The lower we descend on the hill side from 6000 feet, the greater becomes the variety of genera and species.

The species of snakes which I received through Mr. Kurz from the Pegu Yomah (between Prome and Tonghoo) are *Typhlops braminus*, *Simotes bicatenatus*, *Trop. quincunctiatus*, *macrops*, *junceus*, *bellulus* (n. sp.), *Psammodynastes pulverulentus*, *Tragops prasinus*, *Dendroph. picta*, *Hypsirhina enhydris*, *Lyc. aulicus* and *jara*.

Fam. TYPHLOPIDÆ.

While examining a large number of Indian species of *Typhlops*, I found the proportion of the circumference to the length of the body a useful character, and the number of longitudinal rows of scales generally very constant. These two characters were also regarded by Dr. Günther as important in distinguishing species, but Prof. W. Peters appears to have come to an almost entirely contrary result, particularly regarding the latter.

TYPHLOPS HORSFIELDII, (I. R.,\* p. 173).

This species, as characterized by Gray and Günther from typical sub-ocular being present. There are two black streaks at the side of the body, one originating just above the orbit, and the other at about the middle of the posterior edge of the same, they become confluent at the side of the neck, joining two shortstreaks from the posterior edge of the occipitals, not forming, however, a ring.

\* The quotation (I. R.) in parenthesis refers to Dr. Günther's Reptiles of British India, published in 1864, by the Ray Society.

Khasi hill specimens, extends from Mergui northwards through Burma and Assam into Sikkim. I have seen specimens from all these parts. The median row of scales along the back is in a specimen from Pankabaree of a slightly darker colour than the rest of the body; this specimen has 26 long. rows of scales on the anterior part of the body, and 27 just behind the middle.

Dr. Günther (l. c., p. 173) suggests that Dum. and Bibron's *T. Diardii* may be the same as the present species, and Prof. Peters (Monatsb. Berlin Akad., 1865, p. 262) appears to have no doubt about their identity. Dumeril and Bibron give in *Diardii* 36 long. rows of scales which is probably a misprint for 26. But what makes me doubtful about accepting the older name *Diardii*, is Prof. Peters' identification with it of his *striolatus* and Günther's *bothriorhynchus*. I have not seen a specimen of the former, but would consider it a distinct species according to Günther's description; the latter I shall notice presently. Moreover, in a more recent volume of the "Monatsberichte" (1868, p. 450), Prof. Peters says that an adult specimen of *Diardii* has 28, and a young one only 18 long. rows of scales. I do not mean to assert that species of *Typhlops* should be distinguished solely according to the number of rows of scales, but I can say that I never observed anything approaching such a variation in any Indian species of *Typhlops*. Indeed, if the proportions of the body should be the same in those two forms, the scales certainly cannot be of the same type, and *vice versa*.

2. TYPHLOPS BOTHRIORHYNCHUS, (I. R., p. 174).

The type was from Penang, wherefrom I also received several specimens, though very probably they were collected in the Wellesley Province, opposite Penang. Dr. Anderson (J. A. S. B., vol. xl, pt. ii, p. 33) quotes the species from different parts of Assam, and I have lately obtained through Dr. Day a specimen from near Hurdwár. All these specimens agree almost exactly in every point of structure, proportional size and coloration, with Günther's description. The Hurdwár specimen, for instance, has 24 long. rows of scales, 312 trans. rows on the body, and 9 on the tail, the latter terminating with a sharp point. The head shields are exactly

as figured by Günther in *bothriorhynchus*, and not as in *Horsfieldii*; the circumference ($\frac{1}{3}$ distant from the head) is $\frac{1}{12}$ the length of the body; total length 11 inches, tail about $\frac{1}{4}$ inch; above brownish olive, paler below; the upper coloration appears at first sight uniform, but when the specimens had been a little dried, the base of each scale appears darker, and is separated from the slightly less dark terminal half by a pale line.

Professor Peters, as already observed, identifies this species with *Horsfieldii* (and *Diardii*), but when we find specimens with constant characters distributed over such a large geographical area, as the one I have noticed, there is, I think, reason to believe, that they constitute a good species, and, therefore, I would consider *bothriorhynchus* as such, until its identity with the previous species has been more satisfactorily proved.

TYPHLOPS BRAMINUS (I R., p. 175).

This is the most common Indian species, occurring in Ceylon, and extending, through South and Central India, northwards into the warm valleys of the lower Himalayas, westwards all through Bengal and Burma into the Malayan Archipelego. In some 50 specimens (several of which were only 3 inches long) from Burma, Bengal, North-West and Central Provinces, I almost invariably found the 20 long. rows of scales, when counted in a distance of one-third the length of the body from the head. In very few instances only was there one scale less on the neck, or one more in the middle of the body, but the variation was never greater. This makes me believe that the number of longitudinal rows of scales is among others a very good character. As a rule the number of scales appears to be independent of the diameter of the body, as I shall again notice when speaking of *T. porrectus*, n. sp. The usual length of full grown specimens is 6 inches, some examples reaching 7, but very rarely 8 inches; the thickness is nearly uniform throughout, except at the neck, which is slightly thinner, and the head is more or less flattened. I found the proportion of the circumference of the body to its length vary between $\frac{1}{12}$ and $\frac{1}{17}$, the former being the most common, $\frac{1}{14}$ not unusual, $\frac{1}{16}$ th very rare, and $\frac{1}{17}$ th was only observed in one half grown specimen.

The upper side is lighter, or darker, greyish, or olivaceous, brown, the basal half, or two-fifths of each scale being darker than the rest; the lower side is either greyish, or almost purely, white; round the mouth, the tip of tail and in front of the anus generally purely white, except in very young specimens, which are of a more uniform coloration throughout.

In addition to the synonyms of this species, quoted by Günther, Peters gives\* *Argyrophis truncatus*, Gray, (from the Philippines) and *Onychocephalus capensis* Smith (from ?), and considers it probable that *Typhlops accedens*, Jan, and *T. pammeces* of Günther also belong to it. As to the three first suggestions I cannot speak from experience, but the last named species of which I have examined a few specimens† I am inclined to consider with Dr. Günther provisionally as distinct from *braminus*.

The specimens which appear to me referable to *T. pammeces* are all of a nearly uniform pale brown color, while in true *braminus* the lower side is always conspicuously paler than the upper; the proportions of circumference in *pammeces* I found to vary between $\frac{1}{20}$ and $\frac{1}{26}$, indicating a decidedly thinner snake than *braminus*; the structure of the headshields and the number of longitudinal rows (20) of scales is in both the same, as stated by Günther.

TYPHLOPS PORRECTUS, n. sp. Pl. xxv, figs. 1—4.

Body very long, slender, of nearly equal thickness throughout, neck somewhat contracted, but the head is again slightly broader and depressed. Rostral broader above than in front, its width above being about one-third of that of the head, the posterior margin is slightly narrowly rounded. The nostrils are placed rather in front than laterally. The nasal is divided from the fronto-nasal at the lower side, but in front towards the rostral both are united. The fronto-nasals extend posteriorly slightly beyond the rostral, but do not meet each other. The nasal is in contact with the first and second upper labial, the former being very small; the fronto-nasal touches only the 2nd labial. The præ-ocular and ocular are about

\* Monatsb. Berlin Akad., 1865, p. 262.

† These are all in the Indian Museum, except one which I obtained about two years ago near Calcutta.

equal in size, but each is shorter than a fronto-nasal; the præ-ocular is in contact with the 2nd and 3rd, and the ocular in contact with the 3rd and 4th labials. The præ-frontal, frontal and supra-oculars are subequal in size, the parietals a trifle larger, and the inter-parietal a little smaller, followed by a slightly larger scale. The eye is very indistinct, situated below the anterior part of the suture between the supra-ocular and the ocular. The first upper labial is very small, and in young specimens hardly traceable, the second is distinct, the fourth considerably higher, but longer than the third, and both reach well upwards at the side of the head. All the shields of the head are finely punctate.

Of eight specimens measured, of various sizes and ages, the circumference was between $\frac{1}{24}$ th and $\frac{1}{27}$ th of the length of the body, the majority of the specimens being $\frac{1}{26}$ th; the tail equals about the head in length, it is slightly curved and terminates with a short, blunt point. There are 18 longitudinal rows of smooth shining scales round the body, in young as well as in full-grown specimens; the diameter is 2.5 or 3 mm.; 406 (in young) to 416, 428, 440 (in adults) transverse rows of scales round the body and 11-12 rows round the tail.

The general colour is very like that of *T. pammeces*: above pale chocolate or leaden brown, below paler, the two colours passing insensibly at the sides into each other; head, above, and partially also the neck, whitish, in front and below purely white; in front of the anus and the entire tail below white. In some dark coloured specimens there occasionally occur traces of small white blotches at the side of the body; the median row of scales along the belly is also sometimes a little paler than the rest of the underside. All scales have their bases darker coloured than the remainder, but on the upper neck the reverse appears to be the case, the base of each scale appearing in reflected light whitish, while the terminal half is darker brown. The sutures between the head shields above are dotted with white.

The usual length is between 6 and 7 inches. The longest specimen measured is 11 inch., the circumference being only $\frac{1}{22}$ nd of the length of the body. In this adult specimen which is from Hurdwâr, the head becomes remarkably small and is almost thinner than the neck; but it has 18 longitudinal, and 440

transverse rows of scales, and the head shields are as described above; the smaller basal portion of the scales, however, is almost throughout apparently the lighter one, it being blackish grey in reflected light, while the larger terminal part is brownish.

I have obtained this species alive in the neighbourhood of Calcutta, and collected it also at the foot of the Parisnáth hill, (in Western Bengal); one specimen was sent to me by Mr. Mandeli from the base of the Rangnu valley below Darjiling, and a young specimen was obtained south of Agra. Most likely the species has as wide a distribution, as *T. braminus*. In general form it very closely resembles Günther's *T. pammeces*, but differs from it in the structure of the head shields and the number of scales round the body; the latter are 18 in number, as in *T. mirus* from Ceylon, but the head shields are different, the nasal being in the latter separate from the fronto-nasal, and there being a sub-ocular present; the body is also thicker in proportion.

Pl. xxv, Fig. 1. Outline of the body in natural size, figs. 2, 3, 4, side, upper and lower views of head and neck, enlarged.

TYPHLOPS ANDAMANENSIS, n. sp. Pl. xxv, figs. 9-12.

Body moderately slender, head depressed, roundly obtuse in front, neck conspicuously slender; circumference of body a little less than $\frac{1}{17}$ th of its length. Rostral reaching far on to top of head, rounded behind, slightly broader than one-third of its width. Frontals, supra-oculars, inter-parietals and parietal, regular, subequal in size; nasal small, separated from the fronto-nasals by a suture in front and below; fronto-nasals not meeting behind the rostral; two præ-oculars, one below the other, the lower much smaller than the upper; ocular moderate with the eye indistinctly visible through the shield; an elongated subocular present; four labials: first smallest, elongate, in contact with the nasal, 2nd much larger, narrowly touching the nasal, broadly the fronto-nasal, and again somewhat narrowly the lower præ-ocular, 3rd in contact with the lower præ-ocular and the sub-ocular, 4th slightly smaller than the third, and only narrowly touching the sub-ocular and more broadly the lower post-ocular. Lower rostral small, followed on either side by 5 subequal lower labials. There are

18 longitudinal rows of scales, about 390 transverse rows round the body and 17 round the tail; this is nearly three times the length of the head, very obtuse and terminating with a minute point.

General colour above shining deep brownish black, the base of scales being somewhat dull black, sides vinaceous, paler on the lower side, which is throughout checkered with white; mouth and the tail below, including the tip, also mostly white.

This species resembles in general form and number of scales the Ceylonese *T. mirus*, but differs from it by having a lower præ-ocular besides a distinct sub-ocular, and in the arrangement of the labials; the colour is also somewhat different.

Hab. Andaman islands. A single specimen has been examined; it measures about $6\frac{1}{2}$ inches of which the tail is $\frac{1}{4}$ inch.

TYPHLOPS THEOBALDANUS, n. sp. Pl. xxv, figs. 5—8.

T.—? Theobald, Cat. Rept. Mus. Asiat. Soc. Bengal, 1868, p. 42.

Body very long and comparatively slender, of nearly uniform thickness throughout.

The general structure and arrangement of the head-shields and of the labials agrees with those in *T. porrectus*, but the rostral reaches very far back on the top of the head, and is considerably more than one-third (nearly $\frac{1}{2}$) of its width, much contracted, however, below; the first frontal is very slightly larger than the second, and the inter-parietal is very short, but about equal in width to the preceding frontal. The head itself is rather obtuse and somewhat depressed; the head shields most minutely punctate; eyes perfectly indistinct. There are 22 longitudinal rows of scales round the body; 485 transverse rows on the trunk, and 26 on the tail, which is of considerable length, terminating in an obtuse point, not developed into a distinct spine. The circumference is $\frac{1}{2}\frac{1}{6}$ th the length of the body.

Total length 14 inches of which the tail is $\frac{7}{12}$ th inch. The general colour is rather pale greyish brown, slightly paler below, no particular dark markings are seen on the scales.

The species is readily distinguished from *T. tenuicollis*, Peters, (Monatsb. Berlin Akad., 1864, p. 272), said to be from the Himalayas, and also possessing 22 longitudinal rows of scales, by the great length of its tail.

The single specimen is in all probability from India, but without any specified locality; it is in the old collection of the Asiat. Soc., now held in trust by the Indian Museum.

Figs. 5, 6, 7, side, top and lower views of the head and neck, enlarged; fig. 8, under view of the tail, natural size.

Fam. OLIGODONTIDÆ.

SIMOTES BICATENATUS, (I. R., p. 217).

Not an uncommon species in Pegu, Cachar, Assam and in Lower Bengal extending northwards to the base of the Sikkim Himalaya. The coloration is very variable, as noticed by Theobald in his Catalogue of Burmese Reptiles (Linn. Soc. Journ. Zool. vol. x. The brown longitudinal bands generally disappear in old age, particularly in Burmese examples. Most of the specimens, I saw, have 2 + 2 (instead of 1 + 2) temporals,\* and the lower præ-ocular is sometimes almost obsolete.

Family COLUBRIDÆ.

ABLABES COLLARIS, (I. R., p. 228).

The loreal is sometimes minute, barely $\frac{1}{3}$ rd the size of the præ-ocular. Full grown male specimens have the edges of the ventrals often purplish, similarly coloured to *Trop. platyceps*.

Hab. Assam, and Northern Bengal, North West Provinces, and extending from Sikkim along the Himalayas westward to the Sutlej valley, and up to elevations of about 10000 feet.

COMPSOSOMA RADIATUM, (I. R., p. 243).

This characteristically Malayan species is tolerably common at the base of the Sikkim hills and in the low valleys. I have obtained specimens $6\frac{1}{2}$ feet in length from the Sikkim Terai. Several had the two last maxillary teeth very little larger, and closer together, than the rest, but the median teeth were usually not, or scarcely, enlarged.

COMPSOSOMA HODGSONI, (I. R., p. 246).

I have received this species from Kumaon, through my friend Mr. Lawder. Last year (Journ. A. S. B., xxxix, pt. ii, p. 189), I recorded the occurrence of the species from the neighbourhood of

\* Compare Anderson in Proc. Zool. Soc., 1871, p. 170.

Simla, which gives it a geographical distribution extending over the Southern Himalayan slopes between Sikkim on the east and the Sutlej on the west.

Together with the above species I also received from Kumaon *Dendrophis picta*, which is found up to 6000 feet on the southern slopes of the Hymalayas in Sikkim, Kumaon and the Sutlej valley.

ZAMENIS FASCIOLATUS, (I. R., p. 254).

Rather a fierce snake when molested. It is rare in houses about Calcutta, and feeds on frogs and worms. Full grown individuals (about 3 feet in length) are almost uniform; with the cross bands indistinct. Young specimens have a brighter coloration. One measuring $13\frac{1}{2}$ inches (of which tail is 3") had 21 scales on neck, 22 round the middle of the body; ventrals 200; sub-caudals 32; two præ-oculars, the lower very small; two post-oculars; 2+3 temporals. Günther's figure is on these points at variance with his description.

General colour during life olive green above, posterior part of head variegated with dark brown, with some whitish spots on the occipitals. Body with numerous transverse white streaks, each about one scale wide, edged posteriorly with dark brown. At the sides the streaks often branch off and form indistinct reticulations. Before reaching half the length of the body all the white streaks become dull, and are gradually replaced by narrow pale green or brownish dots. Tail uniform olive above. The two last rows of scales at each side are greenish white, in the penultimate row most of the scales have a pale brown spot, and in the last all have it; upper præ-ocular, the two post-oculars mostly, chin wholly, white; rest of lower side uniform greenish white.

TROPIDONOTUS QUINCUNCTIATUS (I. R., p. 260), var. Pl. xxvi, fig. 1.

This is one of the most variable and at the same time most widely distributed of Indian snakes. It is a true water snake with well developed valvules in the nostrils, which are somewhat laterally situated, and more upwardly turned than in other *Tropidonoti*; it is often found inhabiting holes in the banks of rivers and tanks. Were it not for the very great similarity in general

structure with other more terrestrial species of *Tropidonoti*, it could form a separate genus.

In addition to the numerous varieties recorded by Günther, (l. cit.), Theobald (Linn. Soc. Journ. Zool., vol. x), Blanford and myself (J. A. S. B., vol. xxxix, pp. 190 and 371), I have to notice a peculiar form found by Dr. Day at Rurki in the N. W. Provinces.

This specimen (see pl. xxvi, figs. 1 and 1a) has the usual narrowly triangular shape of the anterior frontals, but the posterior frontals are united into one large shield; 19 rows of scales, the median keeled, the laterals almost smooth; 143 ventrals; 94 sub-caudals. The colour is olive above, on the anterior half of the body the skin between the scales is reticulated with black: 6 alternating, somewhat irregular, longitudinal series of small dull whitish spots, becoming less distinct towards the tail; below, uniform whitish with some traces of black at the outer lateral edges of the ventrals; the two oblique black streaks below the eye are scarcely indicated.

This mode of coloration is very commonly met with in young specimens of this species, particularly in those occurring along the base of the Himalayas and in the Assam and Khasi hills, but in old specimens the olive becomes darker, gradually turning to brown or almost black, the whitish spots become bright yellow, and are often dissolved into reticulations, and the skin between the scales, especially at the sides, is bright vermilion, the latter colour appearing to be rather seasonal than sexual.

TROPIDONOTUS BELLULUS, n. sp. Pl. xxvi fig. 2.

Habit slender, body a little compressed; head not very distinct from neck; eye rather large; anterior frontals moderately truncate in front, smaller, but slightly longer than the posterior; occipital 5-sided, sides concave, longer than the front edge, posterior margins shortest forming a right angle, its length somewhat more than the two frontals together, and about equal to the superciliaries which are somewhat broader posteriorly than anteriorly; occipitals very large, obtusely angular behind; two large nasals; one square loreal; one narrow præ-ocular, reaching to the top of head, but not meeting the vertical; three post-oculars; 9 upper labials, 4th, 5th and 6th entering the orbit; temporals 1 + 2, there being

two large shields behind each other along each side of the occipitals; 19 rows of sharply keeled, rather narrow scales; 140 ventrals, 63 sub-caudals.

There are 20 or 22 maxillary teeth, the last barely longer than the preceding, and all appear to form a continuous series; but the specimen is young and the maxilla not very well preserved. It is, (in *Tropidonoti* at least), very often the case, that young specimens have a considerably larger number of maxillary teeth than old ones.

Colour, above, olive brown, with two longitudinal series of black dots along the back, sides of neck with transverse yellowish bars, the skin next to the bars being intensely black, the bars themselves becoming gradually indistinct, and passing towards the middle of the body into indistinct spots and reticulations; each occipital near the suture with a yellow spot, edged with black, and there is also a similar yellow spot on the shield wedged in between the angular terminations of the occipitals. All three spots very probably disappear with age, as they also do in other allied species. Præ- and post-oculars mostly bright yellow, upper labials greenish yellow, each with its hinder edge black, the same is the case with the lower labials, and all the ventrals and sub-caudals have their edges deep black; chin white; general color below greenish or dull white.

This description is taken from a rather young specimen, measuring only $16\frac{1}{2}$ inches, of which the tail is 5 inch, but it appears to be distinct from any of the known Indo-Malayan species. The general coloration and several points in the structure of the shields of the head closely resemble *T. trianguligerus*, (Reinw.), but, taking Schlegel's figure of this species as a guide, the present form differs by the much more elongated shape of the vertical, larger occipitals, only one anterior temporal, generally smaller and narrower scales, and by the yellow and black bars at the side of the body being differently shaped. The form of the vertical of *bellulus* agrees with that of *T. quincunctiatus* but the frontals are comparatively larger and less pointed in front, and there are 3 labials below the orbit although there are three well developed post-oculars present. In other respects, particularly in the black edged ventrals, the species very closely agrees with the variety described by Daudin, Schlegel and Cantor as *T. umbratus*.

The only specimen was collected by Mr. S. Kurz in the hills between Prome and Tonghoo, in N. Western Pegu.

TROPIDONOTUS HIMALAYANUS, (I. R., p. 268).

The shields of the head are somewhat variable in this species. The normal number of upper labials is 8; but sometimes there are 9 present on one or on both sides, the 2nd and 3rd labials being replaced by 3 smaller ones. The temporals are 1 + 2 or 2 + 2 or 2 + 3, the two latter variations are common in young specimens. In the live snake, the collar is bright orange yellow, the reticulations between the scales on the anterior half of the body are yellow, posteriorly passing into dull white. The lateral pale spots on the upper side are sometimes replaced by transverse narrow white streaks.

The species is not common in Sikkim, and mostly confined to the lower valleys, rarely going up to or above 5000 feet.

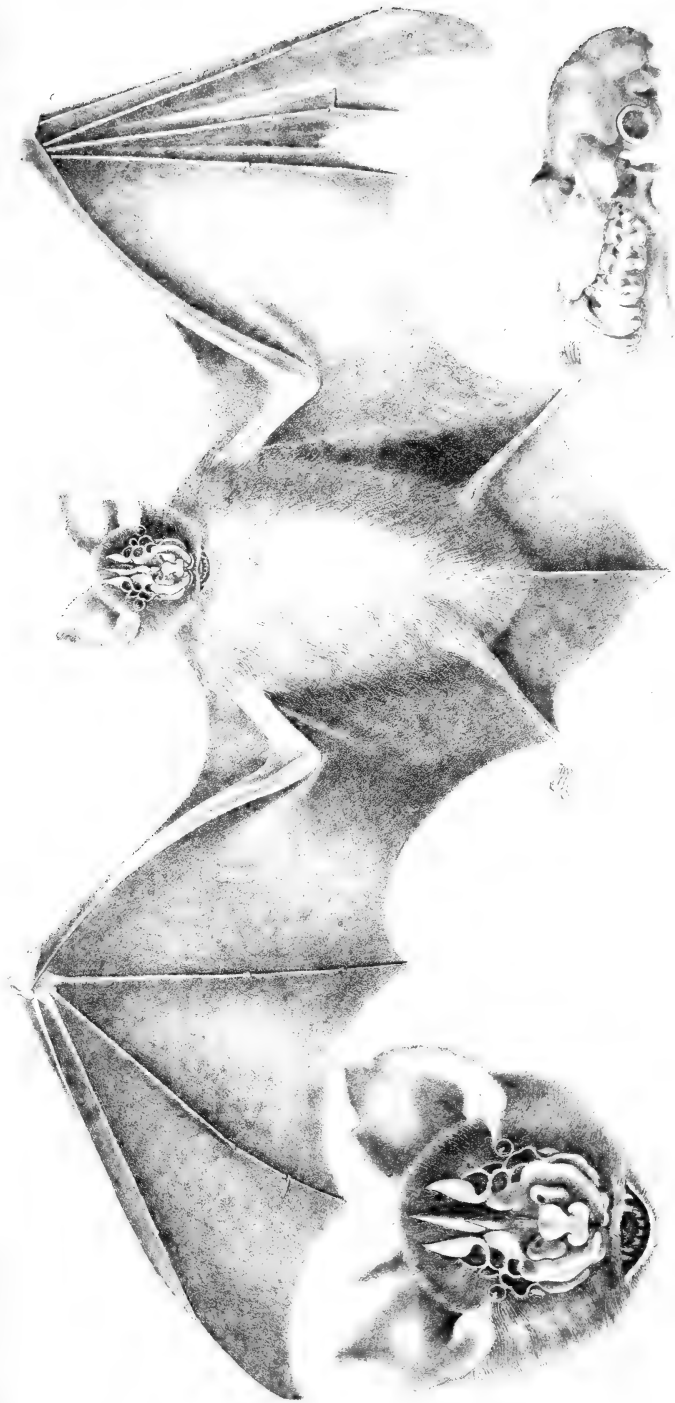
TROPIDONOTUS JUNCEUS, (I. R., p. 268).

This species occurs in Sikkim mostly in the warmer valleys, at about 3000 feet elevation; rarely near Darjiling at nearly 6000 feet; Mr. Blanford found it in the Tista valley at Thamlung, at about 5000 feet. Mr. Kurz collected some specimens in the Pegu Yomah, between Prome and Tonghoo.

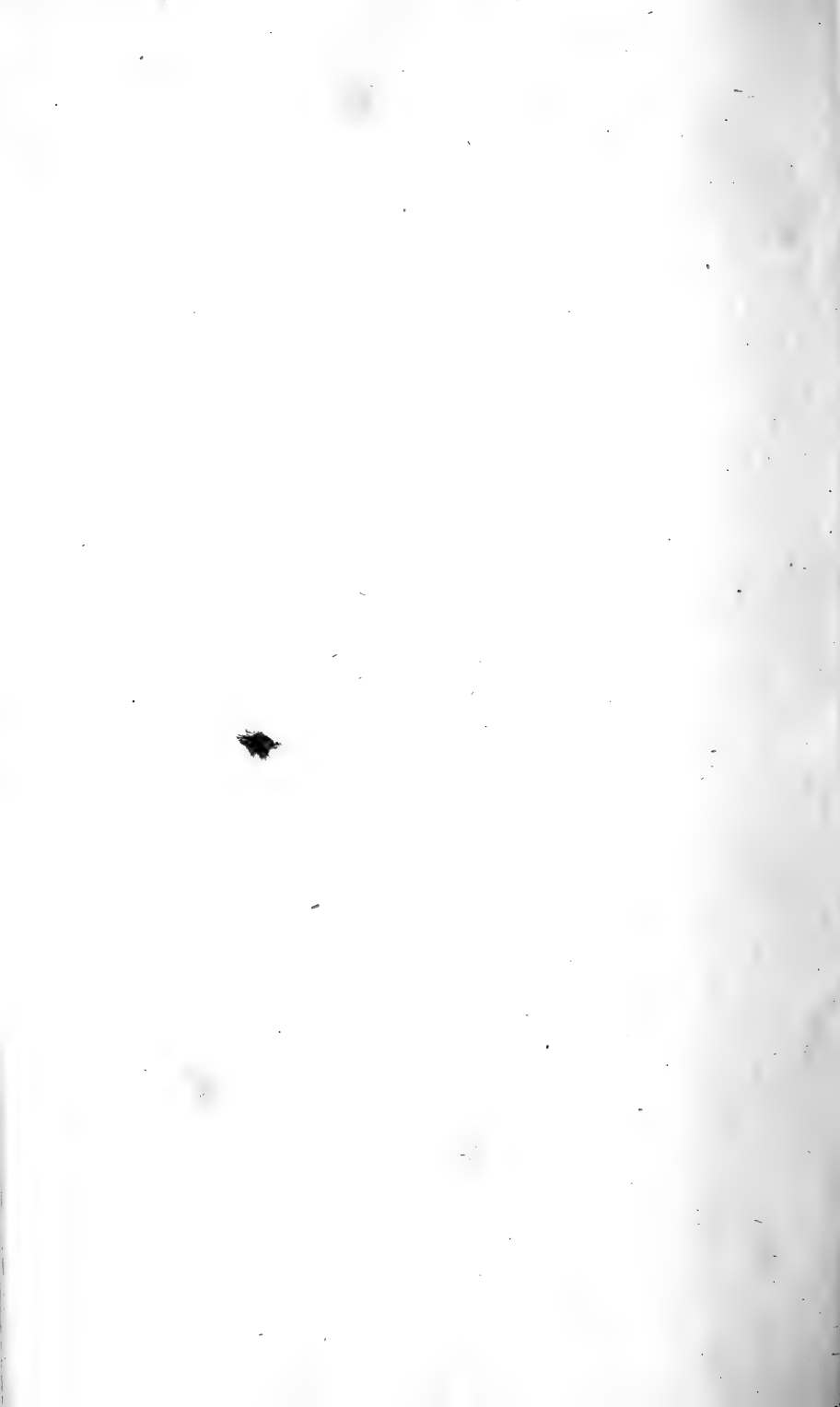
The species rarely attains a larger size than 30 inches. The general coloration is as described by Günther, but the lower side is during life distinctly yellowish; the lateral black dots on the ventrals are sometimes partially, sometimes altogether, absent, and male specimens often have a red band running at each side of the body along the edges of the ventrals, similar to that seen in *Trop. platyceps*.

TROPIDONOTUS SUBMINIATUS (I. R., p. 265). Pl. xxvi, fig. 3.

A common species in Pegu, Assam and Sikkim and, although chiefly inhabiting hilly country, it is rarely found above 3000 or 4000 feet, but mostly at lower elevations in the warm valleys. Sikkim specimens perfectly agree in their bright coloration with those from Pegu, described by Theobald in vol. x of Linn. Soc. Jour.,



Trienops papuensis.



Zoology. The head is greenish olive, the collar brownish green or black, margined posteriorly with more or less bright orange yellow, most conspicuous at the sides; on neck not only the interstitial skin but also the scales are in males strongly tinged with bright vermilion. Body brownish or greyish olive, anteriorly; or entirely, reticulated with black and yellow; tail uniform olive green.

The usual size is 2 or $2\frac{1}{4}$ feet, it rarely grows above 3 feet, and specimens of this size lose very much of their former bright coloration. A very large specimen was sent to me from the Rangnu valley below Darjiling; it measured 44 inches, of which the tail is 11 inches. This specimen is above uniform brownish green, neck behind the head yellowish green, followed by a large vermilion patch. There are at the sides only traces of yellow reticulation, this colour turning to white in spirits; anterior ocular whitish, lower portions of upper labials pale; below uniform dull white, sides of all ventrals and sub-caudals tinged green, like the upper body, but without any black dots. The black spot below the eye, so conspicuous in younger specimens, is entirely absent. This same specimen (comp. pl. xxvi, fig. 3,) differs somewhat in structure also from others. There are 19 rows of keeled scales, the outermost at the sides much enlarged and smooth; vent. 159; sub-caudals 81; vertical pentagonal, with a broad front edge, its length about equal to one of the sides which are slightly concave and converging posteriorly; each supra-orbital smaller than the vertical, and barely longer; each occipital larger than vertical, posteriorly angular; 3 post-oculars (rarely 4, on one or on both sides), 9 upper labials,\* 4th, 5th and 6th entering the orbit, the 7th, and 8th largest; temporals 2 + 3, the two anterior are in contact with the two lower post-oculars, and the lower is much larger than the upper. The three posterior temporals are arranged in an oblique line extending from the occipital to the 9th labial. Lower labials 10, the two first appear to be a divided shield, and 9 seems to be the normal number. The last three lower labials rapidly decrease in size, and below them is a single large shield, occupying a similar position to that in Schlegel's figure of *trianguligerus*.

\* This is the usual number in Sikkim and Burmese specimens, 8 labials are rather rare.

The dentition varies with age. Young specimens generally have 22 maxillary teeth, the last two large and widely separated from the rest. In full grown individuals, the number is reduced to 14,\* of which the two last are very large, and enclosed in a separate pouch.

TROPIDONOTUS MACROPS, Blyth.

Journ. Asiat. Soc. Bengal, 1855, vol. xxiii, p. 296, and Günther, I. R., p. 263.

Syn. *Trop. macrophthalmus*, Günther, 1858, (I. R., p. 262, pl. xxii, fig. C).

? *Trop. Sikkimensis*, Anderson, Journ. A. S. B., 1871, vol. xl, p. 17.

Although the description of the coloration of Blyth's *macrops* perfectly coincides with that of *macrophthalmus*, as described and figured by Dr. Günther, there are in Blyth's original description of *macrops* two curious mistakes which naturally prevented Günther from identifying his snake with that of Blyth, and which could not have been detected without the examination of the original specimens of *T. macrops*.

Blyth says (loc. cit. p. 297)—“Seventeen ranges of scales: scutæ 164—6; scutellæ 130—46 pairs;” and again further on “scutellæ 124 pairs only.” I have examined the type specimens, and I find in the specimen quoted by Blyth as being 31 inches long, of which the tail is $6\frac{1}{4}$ inches, that there are 19 rows of scales on the anterior part of the body, but only 17 rows behind the middle; there are 168 ventrals, or, if we exclude two single shields following the chin-shields and properly situated under the head, there are 166, as quoted by Blyth; and there are $74\frac{1}{2}$ pairs of sub-caudals, or if we exclude one smaller shield immediately following the anus and the single one occupying the tip of the tail, there are 73 pairs, which number doubled gives “scutellæ 146,” as stated by Blyth, the addition “pairs” in this instance being also a *lapsus calami*. What size would the shields of 146 pairs of sub-caudals be in a tail of which the length is only $6\frac{1}{4}$ inches? An exactly similar mistake is repeated in the case of the other typical specimen of 25 inches, of which the tail is $5\frac{1}{4}$ inches; it has 167 ventrals (including three situated below the head which Blyth had

\* I never met a specimen with only 12 teeth, but Günther records that number.

evidently not counted), and 74 pairs of sub-caudals. The third more uniformly coloured specimen has 170 ventrals, and 75 pairs of sub-caudals. All specimens have traces of dark spots on the ventrals.

Thus the identity of *macrops* and *macrophthalmus*, both of which came from the vicinity of Darjiling, cannot be questioned. But I very much doubt that even *T. Sikkimensis*, lately described by Dr. Anderson from the same locality, is anything but a rather uniformly coloured variety of *macrops*. General form, dilatable neck, large eye, structure of shields on the head and scales on the body are to all appearance perfectly identical. The only difference I can trace between *macrops* and the few specimens referable to *T. Sikkimensis* is, that in the latter the vertical is a little longer, but this is not the case to any such extent as would not be found repeated in other varieties of one and the same species.

In the two specimens, described by Anderson as *T. Sikkimensis*, the scales are somewhat feebly keeled, but this is most likely a sexual difference. I have obtained a male specimen from the Rangnu valley below Darjiling, and in this the scales are very distinctly keeled, (precisely as in *macrops*). It has, like the type, 19 rows of scales, posterior to the middle 17, and towards the anus only 15 (like *macrops*). The anterior frontals are slightly less than, or equal to, one half of the posterior frontals, which is also the case in the two types of *Sikkimensis*. Vertical 5-sided, the lateral sides about equal to, or shorter than, the front margin, but not longer; the posterior sides are shortest and form a right angle. The supraciliaries are slightly longer than the vertical; the occipitals are obliquely truncate behind, meeting at the suture with an inwardly bent angle. Temporals 2 + 3. Anterior chin-shields in contact with 4 or 5 lower labials. All these variations of structure are perfectly the same, as may be seen in specimens of *macrops*.

As regards general coloration, my specimen agrees with *macrops* (typical) in being brown above, while both those\* described by Dr. Anderson are pale olive; front neck tinged with green, but without a distinct collar; body reticulated with black and yellow, the black having an inclination to form laterally irregular blotches.

\* But fresher specimens which he subsequently received are also distinctly brownish.

Below, anterior half bright yellow, gradually passing into dull greenish white on the posterior half; most of the ventrals with two large quadrangular, sometimes confluent, blackish spots, these spots become less distinct on the posterior belly, and disappear on the tail. The bent up portion of all the ventrals is dusky brown; tail below most minutely freckled with dark.

I have compared several specimens of typical *macrops* with four specimens referable to *Sikkimensis*, but I confess I cannot persuade myself to believe that they belong to two distinct species. It is true, none of the four specimens of the latter have a dorsal series of distinct pale spots and a very distinct collar, while seven specimens of typical *macrops*, which I examined, have the dorsal series of pale yellowish spots distinct, but Günther says of his *macrophthalmus* "uniform or with a dorsal series of reddish brown spots." This statement almost removes the last doubt one could have about the identity of the two forms. Both have 20-25 closely set maxillary teeth, the two last stronger but scarcely separated by an interspace from the others.

I also received through Mr. Kurz a specimen of *macrops* from the Pegu hills between Prome and Tonghoo.

TROPIDONOTUS PLUMBICOLOR, (I. R., p. 272).

This species extends from Ceylon all through South India, Central India, Qualior and northwards towards Amballa. Dr. Waagen lately obtained through a collector a specimen from as far east as Sahibgunj, on the west side of the Ganges, and this locality may be regarded as the present known eastern limit of the distributional province of the species: it lies almost on the boundary between the Indian and the Malayan fauna.

The collar is in young specimens bright yellow or orange, changing to white in spirits. It disappears in some specimens sooner than in others, occasionally long before they are full grown.

Fam. PSAMMOPHIDÆ.

PSAMMOPHIS CONDANURUS, (I. R., p. 291).

A specimen collected by Dr. Day at Hurdwâr agrees in coloration with those\* described from Simla, in J. A. S. B., vol. xxxix,

\* Dr. Anderson has been so kind as to re-describe these specimens in Proc. Zool. Soc., for 1871, p. 182.

p. 96, but the head is uniform greenish brown. The two light dorsal bands, noted in the Simla specimens, become, however, apparent on the neck, uniting again on the posterior $\frac{1}{4}$ of the body into a single broad, pale yellowish brown band, which disappears at the root of the tail, the latter being uniform olive brown above.

Dr. Günther has described from Sind *Ps. Leithii*, a very closely allied species having the median light dorsal band single along the whole body. I do not think it improbable that this form may be shewn to be only a variety of *Ps. condanurus*, (comp. Proc. Zool. Soc., London, for 1869, p. 505), for the few differences in the structure of the head shields and scales appear to be such as are often liable to variation.

Fam. DIPSADIDÆ.

DIPSAS FORSTENI, (I. R., p. 309).

This South Indian form has also been found in the Bundelcund, and I have received it from Bír bhúm, and from the base of the Sikkim hills at Pankabaree. A specimen from the latter locality measures 58 inches; it has 25 scales on neck and 23 round the middle of the body; temporals 2 + 3, two only being in contact with the post-oculars, ventrals 268, sub-caudals 130. General colour above brownish olive, two blackish ovate spots on neck behind the occiput, followed by somewhat irregular transverse black bands with their angles directed forwards, becoming less distinct after the first third of the length of the body, and at the side replaced by dark reticulations; a blackish streak from each eye to the angle of the mouth, but no streak along the occiput, as usually present in South Indian specimens; below olive grey, lighter on the chin, and further on with a row of white spots on each side, 3 or 4 ventral shields distant.

The specimen had been killed near a house after having a short time previously feasted upon a young chicken.

DIPSAS HEXAGONOTUS, Blyth.

Dr. Anderson has traced the adult of this species, the young of which I described and figured in J. A. S. B., vol. xxxix, p. 198, pl. xi, fig. 4, (Comp. Proc. Zool. S., Lond., for 1871, p. 185).

I have received numerous adult specimens from the Rangnu and Tista valleys in Sikkim and from near Pankabaree. They are all uniform reddish brown above, with the skin between the scales more or less blackish ; yellowish, or partially pinkish, white below. The young snake is marked with numerous narrow transverse dark bands, which disappear with age.

In structure the adult snake does not differ essentially from the young, except that the snout sometimes becomes a little produced, and the size of the anterior frontals is fully, or somewhat more than, one half of the posterior, the vertical is somewhat broader anteriorly than posteriorly. The temporals vary much in size and number, some specimens having only one short temporal in contact with the post-oculars, followed by two longer ones ; but generally there are 2+2+3 or 2+3+3 temporals. The large size of the eye and the low labials below the eye are, besides the coloration, among the most prominent characters of this species. The præ-anal shield is occasionally bifid in young, but in adults appears to be always entire.

There are only 6 or 7 maxillary teeth, the posterior the largest, but there are besides generally 5 or 6 intermediate teeth present which are not permanently fixed to the jaw, being apparently kept ready to fill up vacancies, if any of the other teeth be broken off. Palatine teeth are 10-12, the 1st to 3rd or 4th gradually increase in size, the 3rd or 4th being the largest, the following 6—8 teeth are small and separated from the third by a more or less wide interspace. In the mandible there are 12 to 14 teeth, the anterior somewhat larger than the posterior.

I cannot agree with Dr. Anderson's suggestion (loc. cit., p. 186) that Blyth's *D. multifasciata* is identical with the present species, the former having been re-described and figured by me in Jour. Asiat. Soc., Beng., vol. xxxix, p. 199, pl. xi, fig. 6. I have again examined Blyth's typical specimen of *multifasciata*, and find it to agree perfectly with my former account. A cursory inspection of my figure will shew, that the eye of *multifasciata* is very much smaller, that consequently the upper labials are more developed, the præ-ocular is also much smaller and narrower, the snout slightly less abruptly contracted, the vertebral series of scales

less enlarged and more elongated. The transverse dark bands in the young are narrow, but distinct and directed forwards on the back; in the adult the bands are dissolved into spots, more or less distinctly arranged quincuncially; there is always a dark band present from the eye to the angle of the mouth; the lower side is checkered and more or less spotted with brown.

D. hexagonotus, as compared with the above, has the eye much larger, the præ-ocular well developed, the whole head is comparatively stouter and more bulging, the vertebral series of scales larger and more distinctly hexagonal. The general colour of the body is ferruginous brown, instead of fulvous brown, the dark bands in the young are moderately broad, and cross the back in an almost straight course, and the belly has only occasionally slight traces of darkish spots; but all the spots and bands above and below disappear with age.

I do not think that the specific distinction of these two forms can be questioned. The former resembles in coloration *D. Forsteni*, and belongs to the fauna of India proper, the latter belongs to the type of *D. bubalina*, or *boops*, and characterises the Malay fauna.

DIPSAS BUBALINA (I. R., p. 311).

A specimen measuring 42 inches, obtained in the Rangnu valley below Darjiling, agrees in all essential characters with Günther's description of the above species; it has 250 vent., and 124 sub-caudals. The head is not so stout, and the neck decidedly more slender than indicated in Günther's figure, but this could not be regarded as a specific distinction; there are 3 + 3 + *pl.* temporals on both sides of the head, all three anterior ones being in contact with the two post-oculars. Colour above bluish green, below yellowish white, gradually assuming a greenish tinge posteriorly; the lower light colour is separated from the upper by a faint whitish line, which runs on each side along the ventral shields, some distance from their terminations; on the tail the pale line becomes obsolete. Inside mouth, the interstitial skin on the head and neck is black, but very faintly so on the rest of the body.

Blyth's *D. nigromarginata* from Assam is clearly identical with *bubalina*, the apical grooves are so faint, as to be hardly traceable,

but they are present\* in the type specimen. The interstitial skin is distinctly black on the head and neck, but less so on the rest of the body, the neck is slender, as in the Sikkim specimen previously noticed.

The latter has only eight permanently fixed teeth in each maxillary, there are, however, seven others interposed between them, hardly differing in size, but not fixed to the jaw; 14 palatine and about an equal number of mandibular teeth, the anterior 3 or 4 of these are considerably larger than the rest.

Adult specimens of *hexagonotus* chiefly differ from the present species by their shorter head, generally somewhat longer occipitals, less high upper labials, and by their ferruginous coloration.

DIPSAS TRIGONATA, (I. R., p. 312).

I have examined some specimens of this common species from South and East of Agra, and they had the white, dark edged, bands quite isolated from each other in crossing the back, and not connected by a zigzag line along the median line as is more usually the case.

Fam. LYCODONTIDÆ.

LYCODON JARA.

Leptorhytaon jara, I. R., p. 321.

Dr. Günther made this species the type of his new genus *Leptorhytaon*. The principal differences given between the characteristics of *Lycodon* and *Leptorhytaon* are, that in the former the body is "slightly compressed," and the "nostrils between two shields," while in the latter the body is said to be "not compressed," and the nostril in "one nasal shield."

I have examined several specimens of the present species; some taken alive near Calcutta, others from the base of the Sikkim Himalayas and from Pegu, and I find that in *L. jara*, the body is quite as much, or rather quite as little compressed, as, for instance, in *Lycodon aulicus*. One specimen has a distinct suture above the nostril, dividing the shield into two parts, and below the nostril there is a groove indicating a suture. Two other specimens have clearly two nasal shields, as perfectly distinguishable as they are also in *L. aulicus*.

\* Not absent, as I stated in J. A. S. B., vol. xxxix, p. 199.

The scales are in both the species referred to apparently smooth, but under the lens a very fine striation, or rather sulcation, is perceptible in both. The habits and general characters of both are also exactly the same.

I do not consider it, under these circumstances, necessary to separate the present species *generically* from *Lycodon*.

To the description of the species I may add, that each scale has a very minute sub-apical impressed dot.\* The occipitals are as a rule obtusely angular posteriorly. The præ-ocular is sometimes very small, or it reaches the top of head, and is in contact with the anterior frontals. The 9th upper labial is longer than high. One or two temporals are in contact with the post-oculars.

Fam. HOMALOPSIDÆ.

HYPsirrhina ENHYDRIS (I. R., p. 281).

Specimens, identical in coloration with those noted by Theobald from Pegu (Linn. Soc. Zool., vol. x), also occur in Lower Bengal. Günther says: scales "constantly in 21 series." I have obtained from the Sundarbunds, below Port Canning, one specimen, which has 23 rows of scales; but it does not differ in any other point of structure or coloration from other typical specimens. The lateral pale bands are generally in Bengal specimens distinct, but the brown bands along the back are less so; the central dark line along the belly is often nearly continuous, except on the throat where it is dissolved into spots.

Fam. CROTALIDÆ.

TRIMERESURUS ANDERSONI, Theob.

Trim. Andersoni and *obscurus*, Theobald, Cat. Rept. Asiat. Soc. Museum, 1868, pp. 75 and 76.

In my paper on Malayan Reptiles, &c. (Journ. Asiat. S. B., vol. xxxix, p. 216), I stated that the two specimens described by Theobald under different names belong to one species only. The locality of those two specimens was unknown, though there could have been little doubt, but that the snakes were Indian. I have

\* I have not observed an 'apical groove.'

recently received a third specimen of this species from the Andamans, whence most probably the two type specimens referred to were received.

The characters of the species may be put as follows :

Head very distinct from neck, broad and flat above, a pair of supra-rostrals, separated by an azygos shield, about equal in size to one of the former ; supraciliaries narrow, long ; scales of the head small, slightly carinate on the posterior part : there are from 10-12 of them in an irregular line between the supraciliaries ; scales of body in 25 long. rows, small, imbricate and sharply keeled throughout ; 2nd labial forms the front of the pit, but sometimes the upper portion is partially or entirely detached ; 11 or 12 upper labials ; two rows of scales between labials and orbit ; eye rather large. The two type specimens which are nearly full grown, have each 182 ventrals, 56, the other 71 sub-caudals ; anal entire, strongly projecting. The third specimen which measures only 11 inches, has 181 ventrals and 57 sub-caudals.

The general colour of the snake is dark brown ; when young it has numerous greenish transverse bands on the body, each about 2 scales wide, and about 3 or 4 scales apart from each other ; the sides of the head and the lower side of the body are irregularly marbled and spotted with greenish white. In the more adult stage, the light bands become interrupted on the back which is nearly uniform brown, like the head, but the greenish colour is preserved in more or less numerous and irregular spots at the sides.

Dr. Anderson in his notes on Indian Reptiles, published in the Proceedings of the Zool. Soc. of London for 1871, p. 194, says that *Trim. Andersoni* is identical with *Trim. monticola*. Few species could be more distinct from each other than these. *T. Andersoni* is a much slenderer snake, has comparatively smaller and more sharply keeled scales in 25 rows, narrow superciliaries with 10 or more scales between them on the upper side of the head, 11-12 upper labials, those after the third becoming rapidly smaller and superseded by scales which are not larger, but generally somewhat smaller than the labials ; all three known specimens have on azygos shield, above 180 ventrals and a large eye. The colour is

brown without any large darker spots,\* but sometimes in adults with greenish white spots at the side of the body.

T. monticola, on the contrary, has 21 or 23 (rarely 25 rows according to Anderson) of comparatively much larger and not so sharply keeled scales, 8-9 upper labials, those following the third gradually decreasing in size and superseded by rather large scales; superciliaries rather short and comparatively broad, with 6 or 7 scales in an irregular row between them, generally no azygos shield is present; I never saw the ventrals exceed 160, the eye is small. The body above has always spots darker than is the general brown colour and the reticulation at the sides. This species occurs in the Central and Eastern Himalayas ranging from about 2000 up to about 8000 feet; it is also found in the Khasi hills, and according to Dr. Anderson in Upper Burma. A closely allied species *T. convictus*, was described by me from Penang (J. A. S. B., vol. xxxix, p. 224).

If *T. Andersoni* be identical with any other known species, it can only be with *T. porphyraceus* of Blyth, which I have described and figured in J. A. S. B., xxxix, p. 218, pl. xii, fig. 2. There is very little difference in structure between the two, but the head is not quite so high, and the labials fewer in *T. Andersoni*, the chief difference lying in the coloration; should this, however, prove to vary from dark brown, variegated with greenish white, to almost uniform porphyraceous grey, the two species might be shewn to represent mere varieties.

\* I am at a loss to know how the coloration of *monticola* and *Andersoni* can be called "identical in every respect."

NOTE ON THE CORRECTION OF THE CALCUTTA STANDARD BAROMETER
TO THE KEW AND GREENWICH STANDARDS—*by* H. F. BLANFORD.

[Received 4th September, 1871.]

One of the greatest drawbacks to the value of the Meteorological observations that have hitherto been recorded in India, and one which has gone far to render the large majority of them worthless for advancing our knowledge of the Meteorology of the country, has arisen from the neglect of observers and those charged with the collection of such data, to ensure the reduction of their observations to one common standard. Without this, it is obvious that they cannot be treated comparatively, and any deductions that may be attempted from a comparison of registers must always lie open to the suspicion that the variations they may show are not real, but due to instrumental and perhaps other errors. This is especially the case with registers of atmospheric pressure. As I have more than once pointed out, the variations of this important element are so small in India, that the persistent barometric gradient of a monsoon, existing at any moment between two stations five hundred miles apart, may be entirely concealed or even reversed, in appearance by the uncorrected errors of the instruments in use. It follows that one of the first duties of any officer who may have to supervise the working of a system of meteorological registration, is to ensure that the barometers are carefully compared with some well known local standard, before they are used for the purpose of registration; and that the comparison be repeated from time to time, in order to detect and eliminate errors, which may arise from accidental disturbance or progressive deterioration.

In Bengal, and to some extent in the N. W. Provinces and Central India, the barometer by Newman, No. 84, at the Surveyor General's Office in Calcutta, has been adopted as the standard to which the local observations are corrected. But whether there is any constant difference between this instrument and the standards in use elsewhere, has hitherto been a matter of conjecture. At the present day, most good instruments sent out from England have been compared with the Kew Standard barometer constructed

by Professor Balfour Stewart, and in Ceylon, for instance, at the observatories established two years ago by Captain Fyers, the barometric registers are corrected to the readings of the Kew Standard.

The receipt, some months ago, of a number of very excellent standard barometers by Casella, which had been compared at the India Store Department with a Standard, the error of which to those of Kew and Greenwich had been previously ascertained, has afforded me an opportunity of ascertaining indirectly the difference of the Calcutta standard from these latter instruments, and thus obtaining a correction which will render the barometric registers of Northern India more rigorously comparable than heretofore with those of Ceylon and other places. The comparison, as will be seen, is very indirect, but it has I think been sufficiently extensive to prevent any appreciable error arising from the cause, always assuming that the India Store Department Standard is accurately corrected to those of Kew and Greenwich.

The instruments which have afforded the means of this comparison are of the form figured in Messrs. Casella's catalogues, with tubes of about 0.3 inch internal diameter. Eight of them have been compared by myself with Newman's Standard, No. 94. They were compared one at a time, placed side by side with the latter instrument, and each was read simultaneously with the Newman, nine (in two cases ten) times during the diurnal period of rising, and an equal number of times during that of falling pressure. By this means the correction for capillarity, always more or less uncertain, is eliminated. The readings of each instrument have been reduced for temperature by those of its own attached thermometer, so that the corrections obtained include those, if any, of the thermometers. The total number of comparative readings is 146. The results of this comparison are given in the following table.

The error of Newman's barometer, No. 94, with the standard at the Surveyor General's Office has been ascertained as follows. The former instrument was compared by Babu Gopinath Sen before I received it three years ago, and the mean error of 13 reduced readings then determined to be $-.0245$. A series of levels, from the ground floor of my house to that of the observatory, shewed

the difference of level of the cisterns to be 0·2 foot, my barometer being the lower. This represents a barometric difference of + 0·0002 which must be deducted from the readings of my own standard in its present situation. Of the 146 comparative readings, 73 were made at even hours, simultaneously with the readings of the Surveyor General's Standard, and these give a mean difference of No. 94 = No. 84 (— .0249). The readings were made at intervals between January 7th and August 23rd, the barometric range in this period being from 30·141 to 29·371. The error of No. 94 to No. 84 has therefore evidently remained constant, and may be taken with sufficient approximation as — 0·0251.

The following table gives the results obtained with the several Casella's barometers.

Results of a comparison of eight barometers with Newman's No. 94, the Kew and Greenwich Standards.

| | No. of
Casella's
barometer. | Error to No. 94. | | | Error to
Kew. | Error to
Green-
wich. |
|--|-----------------------------------|------------------|----------|---------|------------------|-----------------------------|
| | | Rising. | Falling. | Mean. | | |
| | | Inch. | Inch. | Inch. | Inch. | Inch. |
| | 628 | + .0132 | + .0159 | + .0145 | — .001 | + .003 |
| | 632 | + .0188 | + .0158 | + .0173 | + .005 | + .009 |
| | 637 | + .0202 | + .0211 | + .0206 | + .006 | + .010 |
| | 627 | + .0193 | + .0188 | + .0190 | + .006 | + .010 |
| | 634 | + .0148 | + .0171 | + .0159 | + .002 | + .006 |
| | 635 | + .0209 | + .0235 | + .0222 | + .004 | + .008 |
| | 630 | + .0137 | + .0163 | + .0150 | + .001 | + .005 |
| | 631 | + .0181 | + .0203 | + .0192 | + .005 | + .009 |

The error of No. 94, (my office standard) to those of Kew and Greenwich, is obtained in each case by changing the signs and taking the difference of the figures in column 4 and those in columns 5 and 6 respectively. The results, with two exceptions, are, I think, sufficiently accordant to afford an assurance of the general trustworthiness of the mean result.

Error of Newman's No. 94 to the Kew and Greenwich Standards.

| Casella's
barometer. | | With Kew. | With Greenwich. |
|-------------------------|-----|-----------|-----------------|
| By | No. | Inch. | Inch. |
| | 628 | — .0155 | — .0115 |
| „ | 632 | — .0123 | — .0083 |
| „ | 637 | — .0146 | — .0106 |
| „ | 627 | — .0130 | — .0090 |
| „ | 634 | — .0139 | — .0099 |
| „ | 635 | — .0182 | — .0142 |
| „ | 630 | — .0140 | — .0100 |
| „ | 631 | — .0142 | — .0102 |

If we reject the results afforded by barometers No. 632 and No. 635 which depart somewhat widely from the remainder, the mean of the remaining six comparisons gives the error of Newman's No. 94 — .0142 to the Kew, and — .0102 to the Greenwich Standard. Deducting these from the error, above given, of the same barometer to the Calcutta Standard, and changing the sign, we have the error of the Calcutta Standard as follows :—

Error of Calcutta Standard, Newman, No. 84.

To Kew.

To Greenwich.

+ .0109.

+ .0149.

These amounts, or say .011 and .015 inch, must therefore be deducted from the readings of the Calcutta Standard and all registers corrected thereto, to render them comparable with registers corrected to the Kew and Greenwich Standards respectively.

ON INDIAN AND MALAYAN TELPHUSIDÆ, PART I,—

by JAMES WOOD-MASON, ESQ.

(Continued from page 297).

(With Plate XXVII).

TELPHUSA EDWARDSII, n. sp., pl. xxviii, figs. 11—15.

Carapace sparingly hirsute above, more thickly so on the pleural region, broadest along a line dividing the anterior from the

middle third of the mesogastric region, on each side of which the surface is raised into an oval areolet bounded in front by the protogastric, behind and laterally by the branchial lobe which in part bounds it in front; uro-gastric lobes distinct from the rest of the regions and from one another, post-frontal ridge sinuous, coarsely wrinkled, ending about 2 mm. short of the epibranchial teeth, slightly interrupted by the forward position of the epigastric lobes; these are rugose in front, deeply divided mesially and completely isolated from the conterminous regions of the carapace by well-defined grooves; meso-gastric area distinct, sending forwards a narrow tongue between the proto- and epi-gastric lobes; branchial areas divided into anterior and posterior portions by broad, smooth, deep, oblique depressions; the latter being scarcely distinct from the cardiac division; the epibranchial teeth are continued backwards, outwards and inwards as raised denticulated crests, along the inner side of which runs a smooth furrow continuous with the post-orbital furrow; postero-lateral margins rugose behind the termination of the lateral crests, the rugosities being continued downwards and forwards on to the inflected portion of the carapace; orbits and extra-orbital teeth finely crenulated. Front broad, short, very little deflexed, terminated by a smooth margin. The chelipedes are subequal; the two inferior edges of their meropodites are armed with tubercles, their inferior planes bear at their distal extremity and nearer the inner than the outer of the two edges a single spinule, which is also to be remarked in many other species; the third or upper angle is rugose; the succeeding joint is greatly thickened at its distal end and is superiorly coarsely wrinkled and concave; its inner margin is armed with a stout sharp spine, beneath which is a smaller one; the proximal half of the penultimate joint is convex and coarsely granulated externally, internally convex and smooth, except towards the inferior border where two or three rows of small, widely-separated tubercles are to be seen; its upper surface is ornamented by three rows of large tubercles; its distal prolongation is deeply canaliculate and its inner toothed edge is in contact throughout its length with the dactylopodite which is likewise canaliculate externally and compressed, so that its upper border presents a saw-like edge, being ornamented with

tubercles decreasing gradually in size and sharpness from the base towards the tip.

The ambulatory legs are hairy as in *Telphusa hispida*.

Breadth, $38\frac{1}{2}$ mm.

Length, 28 mm.

Hab. Hotha, Yunan; Kakhyen-hills, Ponsee, Upper Burma.
Collected by Dr. Anderson.

Plate xxvii, Fig. 11, *Telphusa Edwardsii*, nat. size. 12. Front view of the same. 13. External maxilliped. 14. Chela. 15. Abdomen of male.

TELPHUSA ANDERSONIANA, n. sp., pl. xxvii, figs. 16—20.

Carapace considerably broader than long, very sparingly hirsute, areolation similar to that of the preceding species; anterior branchial region covered with irregular tubercles which gradually pass backwards into the rugations that thickly mark the postero-lateral margin, the inflected portion of the carapace and a portion of the posterior pleural lobe; epigastric lobes separated from one another and from the protogastries, post-frontal crest curved forwards in the middle; epibranchial teeth well marked and pass backwards on each side as regularly denticulated crests, the denticulations gradually decreasing in size backwards; anterior pleural lobes covered with inosculating *foveæ*, separated from the peristomial portions of the posterior by a tuberculated line which loses its beaded character as it passes upwards to the epibranchial tooth; front broad, especially at the base, tuberculated; its free margin is sinuous, well rounded laterally and coarsely crenated; orbital borders also crenated and rising externally into a salient, forwardly-directed tooth. The median triangular process of posterior border of the epistoma is extremely salient, coarsely crenate, and notched on each side; externally to the notches this posterior border is similarly crenate up to the point at which it begins to form the anterior boundaries of the exhalant orifices of the branchial chambers. Chelipedes subequal; meropodites with their three angles sharply tubercular, their posterior faces rugose and their ventral surface bearing a sharp spinule; carpopodites extremely rugose above, with their inner margins raised into a line of sharp, irregular tubercles above the level of the spine, beneath which an acute smaller one is to be seen, and with their distal articular ends greatly

thickened and rounded as in *Telphusa Edwardsii* to which this species is closely allied; propodites with their upper edge armed with a row of five forwardly-directed spiniform tubercles, externally to which are some small rounded tubercles; the rest of the surface, both externally and internally, is excavated into shallow, inosculating *foveæ*. Above, the dactylopodites are rounded and armed at the proximal end with a small spiniform tubercle, are externally longitudinally canaliculate and can be brought into complete contact with the immoveable arm of the pincers, which is also grooved.

The penultimate joints of the ambulatory legs are longer in proportion to their breadth than those of *T. Edwardsii*.

Breadth, 43 mm.

Length, 34 mm.

Hab. Momien, W. Yunan, at elevations of from 3500—5000 ft.; Kakhyen-hills, Ponsee, Upper Burma. Collected by Dr. Anderson.

Plate xxvii, Fig. 16. *Telphusa Andersoniana*, nat. size. 17. Front view of the same. 18. External maxilliped, 19. Chela. 20. Abdomen of male.

TELPHUSA HISPIDA, n. sp., pl. xxviii, figs. 1—5.

Carapace much broader than long, flattened above, hirsute, especially on the postero-lateral margins and the posterior pleural lobes; the surface is subpunctate and has an areolation very similar to that of *Telphusa Edwardsii*, but the postero-lateral boundary of the oval areolet is not so deep impressed; the epigastric lobes, as in *Telphusa Andersoniana*, are not distinct from the protogastrics behind; the cervical suture forms a very indistinct divisional line between the hepatic portion of the protogastric and the anterior moiety of the branchial lobe, which is obsoletely tubercular; the epibranchial teeth are by no means salient; the more obscurely denticulated crest of the antero-lateral margin is very little elevated, and the smooth furrow along the inner side of it, which is so noticeable in the former species, is absent; a bundle of short hairs springs from between each denticulation. The anterior is separated from the posterior cardiac lobe by a broad, shallow, transverse channel which extends right across the carapace, and these again are similarly marked off from the posterior halves of the branchial lobes. The post-frontal ridge is well marked, bent forwards in the middle, but is neither continuous to the

epibranchial teeth, nor interrupted by the projection beyond it of the epigastric lobes. The orbital rims and extraorbital teeth, crenulated. Front sinuous, short, not greatly deflexed, truncate on each side, irregularly punctate, minute hairs springing in bundles of 2 or 3 from the puncta. The structure of the epistoma is very much the same as in *T. Edwardsii*, but its surface is advanced so as to be more nearly in the same plane with the free margin of the front and the triangular process of its posterior border is more acute; mesially it is devoid of hairs, but laterally it is extremely hirsute. The anterior pleural lobe is distinct but the interpleural portion of the line that marks it off from the rest of the carapace is not tuberculated as in *T. Edwardsii*; neither is the inflected portion of the carapace so distinctly rugose nor so thickly covered with hairs. Of the chelipedes the right exceeds the left in size in the only adult specimen in my possession; the outer, or more strictly speaking the posterior, face of the meropodites is smooth, devoid of hairs, except towards the dorsal edge which is densely covered with bundles of hairs and but slightly rugose. The carpopodite is armed in the usual way with a spine, beneath which is a short bilobed spinule; its upper surface roughly punctate; an impression is to be observed at its distal articular end which is not more than ordinarily thickened. The propodite is coarsely punctate, its lower border is longitudinally concave, its prolongation is externally grooved, and so is the dactylopodite with which it is in contact throughout its whole length. The ambulatory legs are robust; the ridges of all their joints are thickly covered with bundles of hairs; the penultimate joints are similar to those of *Telphusa Andersoniana*.

Length, 31 mm.

Breadth, 43 mm.

Hab. Kakhyen-hills, Ponsee, Upper Burma. Collected by Dr. J. Anderson.

Plate xxvii, Fig. 1. *Telphusa hispida*, nat. size. 2. Front view of the same. 3. External maxilliped. 4. Chela. 5. Abdomen of male.

TELPHUSA TUMIDA, n. sp., pl. xxvii, figs. 6—10.

Carapace slightly broader than long, tumid, punctate, extremely convex in every direction, with an areolation similar to that of the three last described species, but the mesogastric lobe is almost confluent anteriorly with the protogastric and this latter is marked

by a short branch running off from the cervical suture at right angles to it; the cardiac is separated from the posterior half of the branchial area; the epigastric lobes are prominent, anteriorly wrinkled and extend beyond the line of the rest of post-frontal ridge; anterior branchial lobe and post-frontal crest rugose; the latter is slightly indented by the cervical suture, and continuous from the epigastric lobes to the minute epibranchial teeth; antero-lateral margins greatly inclined with minutely denticulated crests; postero-lateral margin marked with oblique wrinkles which assume a tubercular character as they pass forwards on to the inflected portion of the carapace and the posterior pleural lobes which, where they form the peristoma, are completely covered with round, polished tubercles, disposed in pairs; the anterior pleural lobe presents a few scattered tubercles, and is cut off from the posterior pleural and from the inflected region of the carapace by a beaded line. Front broad, deflexed, coarsely granulated, marked by the prolongation forwards of the mesogastric furrow. The epistoma presents the same characters as that of *Telphusa Andersoniana*, except that its anterior margin is distinctly crenulated. The orbits and their external angles are crenated.

Chelipedes subequal; meropodites with their posterior faces and angles very rugose; carpopodites, above rugose, armed internally with a short blunt tooth, above and below which are some smooth tubercles; propodite externally convex and rugose; internally, especially near the lower margin, above, and below tuberculated; the upper margin of the dactylopodite is rounded and presents a short row of tubercles at its proximal end; the pincers are marked on every face with longitudinal rows of puncta and their arms can be almost completely apposed.

Breadth, 29 mm. of a male.

Length, 24 mm. ,,

Breadth, 27 mm. of a female.

Length, 22 mm. ,,

Hab. Hotha, Yunan; Kakhyen-hills, Ponsee, Upper Burma. Collected by Dr. Anderson.—Darjiling (?).

Plate xxvii, Fig. 6. *Telphusa tumida*, nat. size. 7. Front view of the same. 8. External maxilliped. 9. Chela. 10. Abdomen of male.

ON A NEW GENUS AND SPECIES OF RHINOLOPHIDÆ, WITH DESCRIPTION OF A NEW SPECIES OF VESPERUS, AND NOTES ON SOME OTHER SPECIES OF INSECTIVOROUS BATS FROM PERSIA,—*by* G. E. DOBSON, B. A., M. B., *Asst. Surgeon, H. M.'s British Forces.*

[Received and read 7th June, 1871.]

Genus—TRÆNOPS, Dobson (*gen. nov.*).

Nose-leaf horse-shoe shaped in front, tridentate behind; horse-shoe shaped portion consisting of two laminae, of which the overlying one is deeply emarginate in front, with the sides of the emargination turned upwards and supporting the base of a longitudinal, horizontal crest ending above and between the nasal orifices; hinder, erect portion of the nose-leaf with one cell in the centre of its base, the entrance to which is guarded by a lanceolate process of membrane, with cells on the sides of its front surface, and one on each side behind, immediately above the eye.

Dentition:—i. $\frac{2}{4}$; c. $\frac{1-1}{1-1}$; pm. $\frac{2-2}{2-2}$; m. $\frac{3-3}{3-3}$.

First upper premolar minute, placed *outside* the line of teeth.

The above characters of the new genus are derived from an examination of six spirit specimens of a new species of bat from Persia, which I now proceed to name and describe in detail.

TRÆNOPS PERSICUS, Dobson, Pl. XXVIII.

Head long; muzzle broad, obtuse, flattened laterally, lower lip with four small warts on its anterior margin; ears nearly as broad as long, funnel-shaped, with acutely pointed tips; the outer margin commences in a narrow fold of skin arising from the posterior corner of the eyelids, which passing backwards and slightly downwards for about 0.1 in. rises abruptly to a height of 0.2 in. forming the outer side of the ear; the inner margin is convex forwards, and rises to about the same height; at a short distance behind, it is interrupted by a sudden emargination which is succeeded by a triangular elevation of the rim of the ear forming the tip which projects outwards owing to the concavity of the outer side of this

triangle. The form of the ear, which is difficult to describe, is very well given in the plate accompanying this paper.

The nasal appendages are very complicated; the anterior portion of the nose-leaf is horse-shoe shaped, consisting of two laminae, the upper overlying lamina deeply emarginate in front, the opposite sides of the emargination turned upwards and supporting the anterior portion of a broad, flat, longitudinal crest which ends in a triangular head above and between the nasal orifices; these openings are placed at the bottom of a considerable depression, are about .05 in. apart, and between them a very narrow *raphé* connects the apex of the triangular termination of the central, horizontal, longitudinal crest with the base of the hinder erect nose-leaf; this hinder portion arises from a thick root behind the nostrils, its base is hollow, containing a single cell, the entrance to which is guarded by a lanceolate process of membrane; above this opening, the nose-leaf terminates by forming three projections of which the central is needle-shaped, very slightly longer than the others, and its base forms the upper boundary of the entrance to the central cell; the lateral projections are shaped differently, rising on either side of the base of the central projections by narrow pedicels they soon become expanded by the increasing convexity of their outer sides, which converging above form with the inner margins acute terminations.

On each side of the hinder nose-leaf are six cells, of which one is situated behind immediately above the eye occupying the position of the minute pores observed in nearly all the species of Dr. J. E. Gray's second group of *Rhinolophidæ*; in front of the eye two shallow, but well defined, cells are formed by the folds of membrane external to the horse-shoe, of which that nearest the eye has for its posterior wall the raised margin of the eyelid; this cell, like that above the eye, is concealed by the hair of the face, and is not shown in the accompanying illustration of the animal's head.

The total number of cells is therefore thirteen, of which three on each side are formed by the erect nose-leaf, and one occupies the centre of its base.

The entrance to this central cell appears to be normally closed, at least so it is in all the spirit specimens, but may be readily

opened by drawing the lower lanceolate process of membrane forwards and the upper central projection backwards. A small, quadrilateral opening is thus disclosed, having for its lower and upper boundaries the bases of these projections. Through this opening the animal has probably the power of admitting air at will to the central cell which is spacious and most likely acts as an accessory nasal cavity, to the sides of which part of the terminations of the olfactory nerves may be distributed. The form of the lower lanceolate process of the nose-leaf which is laterally flattened in front of the opening to the cell, favours this supposition.

The wings present some remarkable peculiarities of structure. From the outer side of the proximal extremity of the terminal phalanx of the third finger a small process of bone arises with an inclination forwards, and terminates by an obtuse point in the wing membrane in which it is included. The distal extremity of the same phalanx is very shortly bifid as in most *Rhinolophine* bats, but the terminal phalanx of the fourth finger ends in a single point.

Wing membrane attached to the tibia a short distance above the ankle; feet long, slender; toes armed with long and strong claws; tail included in the interfemoral membrane, the extreme tip alone free.

On the upper surface the fur is very pale buff, almost white, with light sepia tips, darkest on the back of the neck, along the anterior margin of the scapulæ, and between the shoulders; towards the root of the tail of a yellowish tinge throughout; beneath, wholly very pale buff or dirty yellowish-white, cutaneous system of the same colour. The fur is everywhere long and dense; in front it covers the posterior surface of the hinder nose-leaf, exceeding in length the height of the trident-shaped crest; the inner edge of the ear, as far as the emargination, is clothed anteriorly with long hairs which also occupy the interior of the conch, but are finer, and more thinly spread in the latter situation; behind, the fur of the back extends on to the base of the interfemoral membrane nearly as far as the end of the second caudal vertebra; on the wing membrane its extent is very limited; beneath, the wing membrane is covered with hair nearly as far as a line drawn

from the middle of the humerus to the middle of the femur, but the humerus and femur are completely naked beyond the body; the distribution of fur on the under surface of the interfemoral membrane is similar to that above.

Dentition:—i. $\frac{2}{4}$; c. $\frac{1-1}{1-1}$; pm. $\frac{2-2}{2-2}$; m. $\frac{3-3}{3-3}$.

The anterior upper premolar is minute with a flattened crown, and is placed *outside* the line of teeth; the upper and lower incisors are bilobed; the upper canines have large cusps at their bases posteriorly.

| | Inches. |
|------------------------------|---------|
| Length, head and body, | 2.25 |
| „ tail,..... | 1.2 |
| „ head, | 0.85 |
| „ ear (anteriorly), | 0.45 |
| „ „ (posteriorly), | 0.35 |
| Breadth, | 0.4 |
| Length, forearm,..... | 2.0 |
| „ thumb, | 0.28 |
| „ second finger, | 2.8 |
| „ fourth do. | 2.0 |
| „ tibia, | 0.65 |
| „ foot and claws,..... | 0.35 |
| „ calcaneum, | 0.45 |
| Expanse, | 10.50 |

The characters of the nasal appendages would be sufficient, according to Dr. J. E. Gray's system of classifying the genera of *Rhinolophidae*\* to require the formation of a new group for the reception of the genus, based on this species, which would thus take its position next the *Rhinolophina* :—

- I. *Rhinolophina*.
- II. *Trienopina*.
- III. *Phyllorhinina*.
- IV. *Rhinopomina*.
- V. *Nycterina*.

The characters of the group are those of the genus as given in the commencement of this paper, and in the absence of other genera must necessarily remain so without modification.

\* Proc. Zool. Soc. 1866.

In a future paper on the osteology of the type species I hope to be able to show that, apart from the characters presented by the nasal appendages, there are points of difference in the construction of the bony skeleton which still further separate this genus from all other genera of *Rhinolophidæ*.

The specimens from which the description of *Trianops persicus* is derived, were obtained at an elevation of about 4750 feet near Shiraz in Persia; at the same place specimens of four other species were also taken, of which one is new, belonging to the sub-genus *Vesperus*,\* *Keys. et Blas.*

VESPERUS SHIRAZIENSIS, Dobson.

Muzzle broad and thick; head flat; nostrils opening sublaterally with a shallow emargination between; ears triangular with rounded tips, inner margin convex, outer margin faintly hollowed out beneath the tip, becoming slightly convex below, again hollowed out opposite the base of the tragus, and terminating towards the angle of the mouth in a small lobe; tragus long, rounded at the tip, with a very slight inward curvature, inner margin almost straight, outer margin slightly convex with a small triangular lobe at the base.

Wings broad; wing membrane attached to base of outer toe; terminal phalanx of thumb nearly twice the length of basal; feet moderately long, slender; toes more than half the length of the whole foot.

The fur of the back is moderately long, and scarcely extends on to the wing membrane except in the immediate neighbourhood of the sides of the body, and on the interfemoral membrane at the root of the tail; beneath, the wing membrane is covered to a greater extent, and fine thinly spread hairs pass out along the posterior margin of the humerus and forearm to the carpus; the fur of the abdomen scarcely extends to the interfemoral membrane, but very fine, almost invisible, hairs rise from the transverse dotted lines with which it is marked. The fur of the head passes forwards upon the face slightly in front of the eyes, the remaining

\* "*Pipistrellus*" in the abstract of this paper in *Proc. As. Soc. Bengal*, June, 1871.

portions of the face are almost naked; the ears are covered posteriorly with fur at their bases which also extends upwards in a triangular form on the inner side, anteriorly the inner margin and part of the conch are clothed with a few short hairs.

Above, dirty brownish buff; beneath, a lighter shade of the same colour.

Dentition:—i. $\frac{2}{6}$; c. $\frac{1-1}{1-1}$; pm. $\frac{1-1}{2-2}$; m. $\frac{3-3}{3-3}$.

Outer incisors very small, and close to inner ones which are nearly three times their length, and obtusely pointed.

This bat is about the size of *Vespertilio murinus* of Europe; it approaches the *Serotine* very closely in some particulars, as in dentition and length of body and tail, but differs in the much greater length of the forearm, in the form of the ear and tragus, and notably in the colour of the fur.

| | Inches. |
|-----------------------------|---------|
| Length, head and body,..... | 2·8 |
| „ tail,..... | 2·0 |
| „ head,..... | 1·0 |
| „ ear,..... | 0·85 |
| Breadth, do. | 0·5 |
| Length, tragus, | 0·35 |
| Breadth, do. | 0·1 |
| Length, forearm, | 2·2 |
| „ second finger, | 4·1 |
| „ fourth do. | 3·0 |
| „ thumb, | 0·38 |
| „ tibia, | 1·0 |
| „ foot and claws,..... | 0·5 |
| Expanse, | 15·0 |

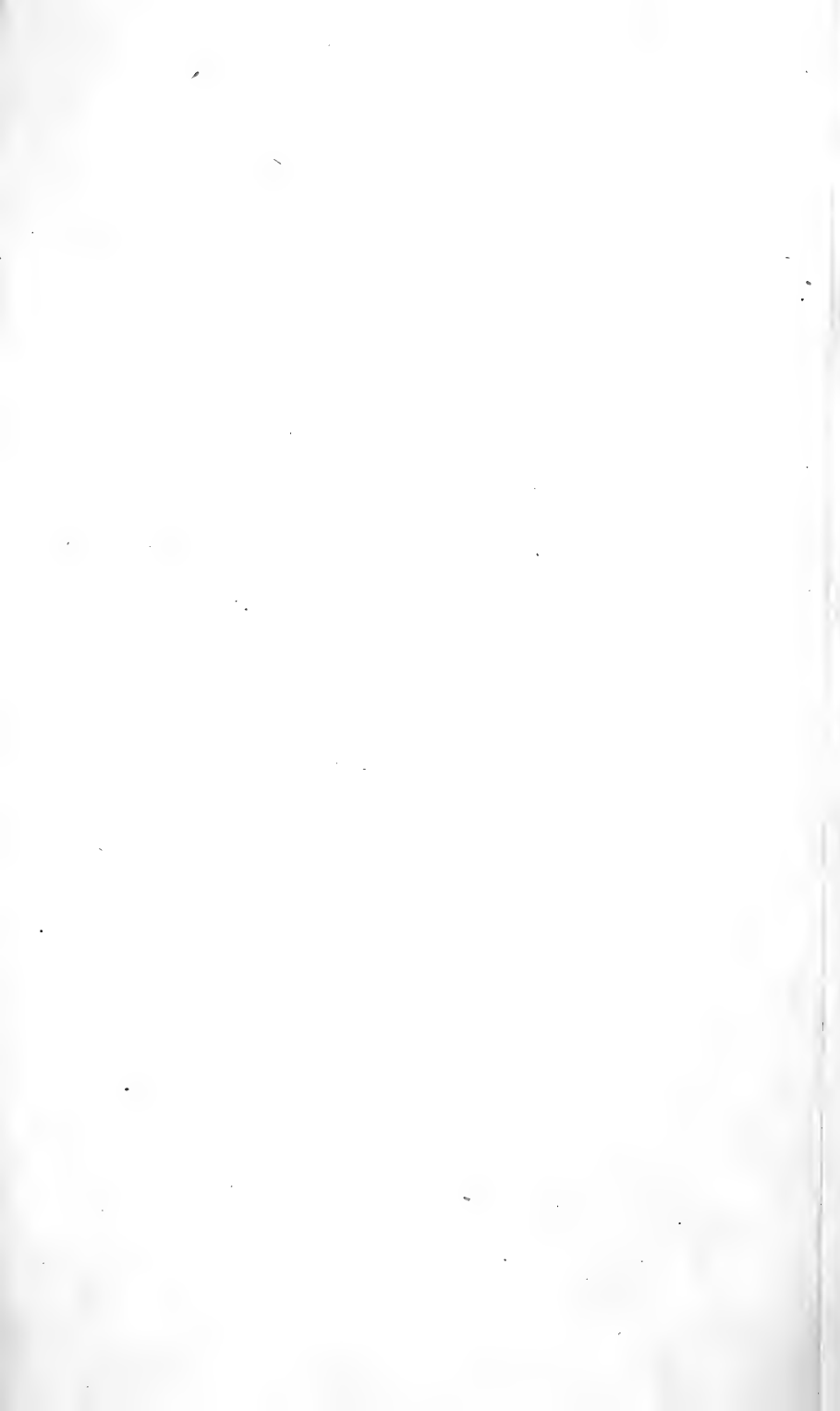
The remaining three species obtained near Shiraz were:—

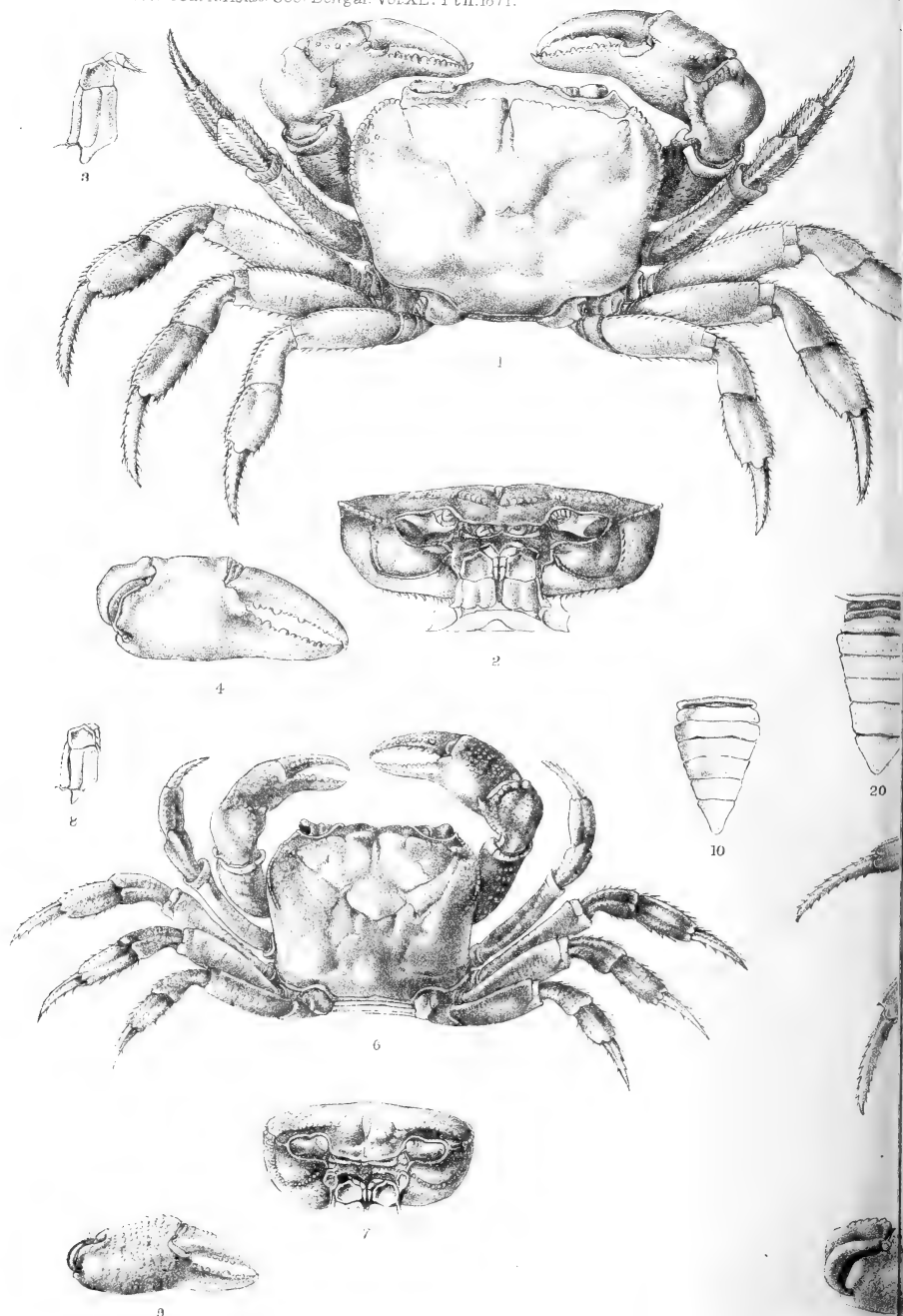
PIPISTRELLUS MARGINATUS.

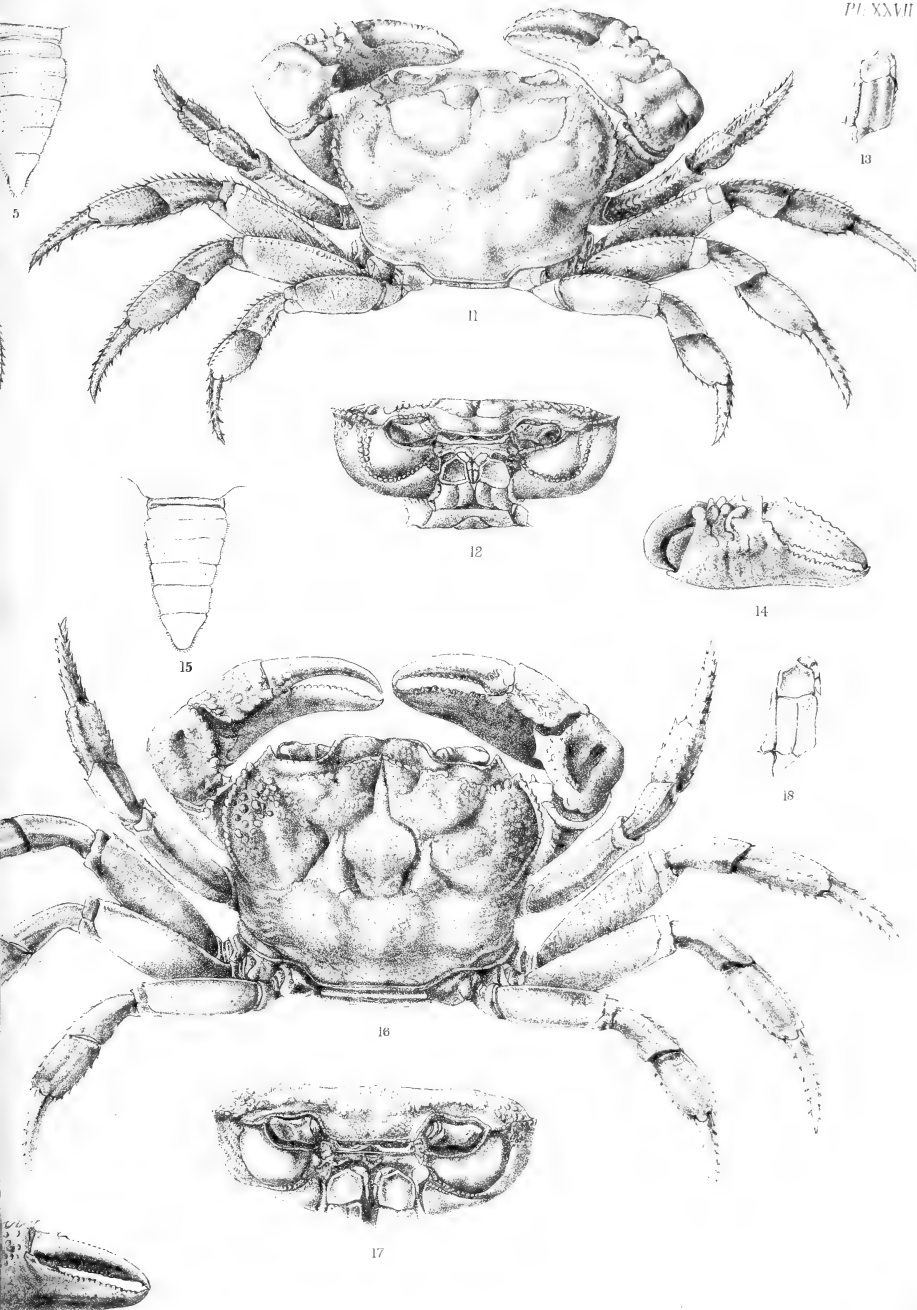
Vespertilio marginatus, Cretschmer.

A dried specimen agreeing very well with the description in Temminck's Monograph.\* The white margin to the wings and interfemoral membranes is very well marked. On the upper surface the fur of the body extends upon the wing membrane as far as a line drawn from the middle of the humerus to the knee joint;

\* Monographies de Mammalogie, vol. ii, p. 202.







10. *Telphusa tumida*.
20. *Telphusa Andersoniana*.

posteriorly, it covers more than one-third of the interfemoral membrane; beneath, it extends to the elbow, but does not occupy so much of the interfemoral membrane which is covered for nearly half its surface with a very few short hairs arising from the transverse dotted lines. Above, black for three-fourths its length, the remaining portion to the tip light yellowish brown or dun colour; beneath, black for the same extent, the ends of the hairs paler than above, becoming white on the belly and pubes.

Inner incisors long and acutely pointed, outer ones short and close to their bases; anterior upper premolars very minute, concealed between the canine and second premolar, and not visible without the aid of a lens.

PIPISTRELLUS COROMANDELICUS.

Vespertilio Coromandelicus, F. Cuvier.

Several spirit specimens of immature individuals referable to this species.

VESPERTILIO MURINUS, Geoff.

A well preserved dried specimen answering in all respects to the description given in Temminck's Monograph;\* above, white with a reddish tinge, beneath pure white; base of the hairs, above and beneath, dusky.



LIST OF ALGÆ COLLECTED BY MR. S. KURZ IN BURMA AND
ADJACENT ISLANDS,—by DR. G. v. MARTENS, in *Stuttgartdt.*
Communicated by MR. S. KURZ.†

[Received 15th July, 1871. Read August, 1871.]

I.—PALMELLACEÆ.

PALMELLEÆ.

MICROCYSTIS, Kg.

[1. *M. aeruginosa*, Kg.—In a pool of sweet water in Kolodyne valley, Arracan. Octob.].—S. K.

\* Vol. ii, p. 178.

† I have arranged the numerous determinations of Burmese Algæ, lately transmitted to me by Dr. v. Martens, according to that author's "Tage der Preussischen Expedition nach Ost-Asien." For any defects in the arrangement of this List, as well as for a few additional species entered between

PALMELLA, Lyngb.

1. *P. subsalsa*, Martens, strato indeterminato effuso; cellulis dense aggregatis 1/200 ad 1/300 lin. crassis, homogeneis, globosis v. ellipticis, lutescentibus; membranula achromatica.—Arracan, on periodically submerged mud of the Kolodyne river, in brackish water. Octob. (K. 1960).

GLÆOCAPSA, Kg.

1. *G. luteo-fusca*, Martens, strato compacto, late expanso; vesiculis primariis evanescentibus; secundariis 1/200 ad 1/180 lin. crassis, globosis, lutescentibus, nucleis ellipticis, solitariis v. geminatis, pallide viridibus, 1/300 lin. longis, 1/500 lin. latis.

Pegu, Northern Yomah, along the dried up bed of Mayzelee Choung. January.—(K. 1854).—Sweet water.

II.—NOSTOCHINEÆ.

OSCILLARIEÆ.

OSCILLARIA, VAUCH.

1. *O. granulosa*, Martens, pulcherrime æruginea; filis 1/300 lin. crassis, rigidis, rectis, apice parum attenuatis; articulis diametro subæqualibus ubique granulosis, geniculis hyalinis non punctatis.—Karen country, E. of Sittang, Toukyeghat, in Pywoon Choung, covering stones in dense dark green patches. March. (K. 1860).—Sweet water.

2. *O. brevis*, Kg.—Pegu, Southern Yomah, near Kya-eng, in a little jungle-creek. Decemb.—Sweet water.

3. *O. viridis*, Vauch. = *tenuis*, Ag.—Arracan, Akyab, in stagnant waters, floating. Octob. (K. 1952).—Sweet water.

4. *O. Grateloupii*, Bory.—Arracan, with the former. Sweet water.

PHORMIDIUM, Kg.

1. *Ph. papyrinum*, Kg.—Arracan, on rocks in clear torrents, Boronga Island. Octob. (K. 1967).—Sweet water.

brackets with my initials, I, therefore, am alone answerable. *Diatomaceæ* and the greater number of *Desmidiaceæ* are not represented, but I hope to have an opportunity of collecting further materials for a more complete list than the present one. The numbers between brackets and the letter "K." have reference to my collection of *Crypt. Cellulares*. The seaweeds commonly eaten by the Burmans, are *Gigartina spinosa*, Grev., (agar agar of the Malays), and *Sphaerococcus lichenoides*, Ag., (Ceylon moss of commerce). These are usually called by the Burmans *Kyoutk pién*.

[2. *Ph. oryzetorum*, Martens in Proceed. As. Soc. Beng., January, 1870, p. 12.—Arracan, low lands, frequent on stagnant tanks and submerged rice-fields, floating. Octob.].—S. K. Sweet water.

LEPTOTHRICHEÆ.

LEPTOTHRIX, Kg.

1. *L. ochracea*, Kg.—Karen country, E. of Tounghoo, Toukyeghat, Choungmenah-hills, in little choungs, floating. March. (K. 1852).—Sweet water.

LYNGBYEÆ.

LYNGBYA, Ag.

1. *L. majuscula*, Dillw.—Karen country, E. of Tounghoo, not unfrequent in the jungle-choungs. Febr. (K. 1858 et 1859).—Sweet water.

SCYTONEMEÆ.

SCYTONEMA, Ag.

1. *Sc. Peguanum*, Martens, cespitè cupreo, lineam alto; filis basi connatis, parce ramosis, cum vagina 1/180 ad 1/150 lin., sine vagina 1/220 ad 1/200 lin. crassis, apice attenuatis hyalinis, vaginis aretis lævibus; articulis diametro subæqualibus, pallide viridibus.

Pegu, Southern Yomah, Tyoben, on the bark of trees. Decemb. (K. 1855).

2. *Sc. aureum*, Menegh.—Karen country, E. of Tounghoo, Toukyeghat, Choungmenah-hills, in the hill Eng.-Forests, on rocks, at from 2500 to 3000 feet elevation. Febr. (K. 1857).—Sweet water.

III.—CONFERVACEÆ.

CONFERVEÆ.

CONFERVA, L.

1. *C. bombycina*, *ε. subæqualis*, Kg.—South Andaman, in the creeks above Watering Cove. Sweet water.

2. *C. fugacissima*, Roth.—South Andaman, in the creek above Watering Cove. June. (K. 1857). Sweet water.

CHÆTOMORPHA, Kg.

1. *Ch. Indica*, Kg.—Arracan, Boronga Island, on other seaweeds in the crevices of sub-marine sandstone banks. Octob. (K. 1946).

RHIZOCLONIUM, Kg.

1. *Rh. occidentale*, Kg.—Arracan, on sandstone rocks in the Kolodyne river, in mangrove swamps. Octob. (K. 1955).

CLADOPHORA, Kg.

1. *Cl. scitula*, Suhr.—Arracan, Boronga Island, on other seaweeds. Octob. (K. 1953).
2. *C. Tranquebariensis*, Roth.—Pegu, Northern Yomah, in Tsoon-Choung. January. (K. 1846).

CHROOLEPUS, Ag.

1. *Ch. villosum*, Kg.—Karen hills, E. of Sittang, Thayet-tchu Choung, on trees, &c., at from 2 to 3000 feet elevation.—March. (K. 1856).

CAMPSOPOGON, Mont.

- [1. *C. Hookeri*, Mont.—Arracan, Akyab, in rivulets. Octob.] S. K.

ZYGNEACEÆ.

SPIROGYRA, Lk.

- [1. *Sp. elongata*, Kg.—Arracan, Akyab, in stagnant and gently flowing waters, not unfrequent. Octob.] S. K.
2. *Sp. nitida*, Dillw.—Arracan, Akyab and Kolodyne valley, rather frequent in stagnant waters. Octob.; Pegu, Southern Yomah, Pongleen. Jan. (K. 1848).
3. *Sp. decimina*, Lk.—Arracan, Akyab, in sweet water creeks. Decemb. (K. 1851).
4. *Sp. jugalis*, Kg.—Arracan, Akyab, in stagnant waters, floating, along with *Oscillaria viridis*, &c. Octob.
5. *Sp. subaequa*, Kg.—Arracan, Kolodyne-valley, in stagnant waters. Octob. (K. 1956).

ULVACEAE.

ULVA, L.

1. *Ul. oxycocca*, Kg.—Arracan, frequent on the sandstone-layers along the shores opposite Akyab. Octob. (K. 1958).

PHYCOSERIS, Kg.

1. *Ph. lobata*, Kg.—South Andaman, on sandstone rocks at Camping Bay.—Apr. (K. 1612).

ENTEROMORPHA, Lk.

1. *E. intestinalis*, Lk., var. *a. capillaris*. Kg.—South Andaman, in brackish swamps of the mangrove jungles.—Apr. (K. 1697).
2. *E. complanata*, Kg.—South Andaman, Ross Island, on rocks. Apr. (K. 1592); also Arracan, Boronga Island.
3. *E. polyclados*, Kg.—Andamans, Ross Island and Middle Straits, on rocks. Apr. May.
4. *E. compressa*, Lk.—Arracan, frequent on the sandstone banks of Boronga Island. Octob. K. 1945.

PROTODERMACEÆ.

INODERMA, Kg.

1. *I. fontanum*, Kg.—Andamans, Labyrinth Archipelago, on Termoklee Island, in sweet water pools of dried up creeks.—May. (K. 1639).

IV.—SIPHONÆÆ.

VAUCHERIEÆ.

VAUCHERIA, DC.

1. *V. clavata*, DC.—Andaman Islands, in sweet waters.
2. *V. sessilis*, DC.—Karen country, Tonkyeghat, in choungs. Febr. (K. 1853).
3. *V. submarina*, Berk.—Arracan, Kolodyne river, in brackish water on sandstone rocks of mangrove swamps, clothing the rocks in dense green patches. Octob. (K. 1962).

BRYOPSIS, Lx.

1. *Br. tenuissima*, Notaris.—South Andaman, Camping Bay, on sandstone rocks. May. (K. 1593).
2. *Br. pachynema*, Martens, Tage d. Preuss. Exped. Ost-Asien., 24, t. iv, f. 2. (*Valonia confervoides*, Harv., Alg. Ceylon).—South Andaman, in mangrove swamps towards Birdnest Cape. Apr. (K. 1606).

CODIÆÆ.

HALIMEDA, Lx.

1. *H. discoidea*, Dene.—South Andaman, &c. Frequent on coral reefs all along the coast. (K. 1691).
2. *H. Opuntia*, Lx.—South Andaman, only ejected from the sea; Pegu, Diamond Island (K. 1651).

3. *H. cuneata*, Kg.—Andamans, Labyrinth Archipelago, Termoklee Island (K. 1693).

V.—*PHÆOSPOREÆ.*

ECTOCARPEÆ.

SPHACELARIA, Lyngb.

1. *Sph. furcigera*, Kg.—South Andaman, Camping Bay, parasitic on *Sargassum aquifolium*.—Apr. (K. 1689/6).

VI.—*FUCACEÆ.*

SARGASSEÆ.

SARGASSUM, Ag.

1. *S. microcystum*, Kg. ? ?.—South Andaman, very frequent all along the coast on rocks and banks, but nowhere full grown (K. 1698).
 2. *S. aquifolium*, Ag.—South Andaman, Camping Bay. (K. 1689).
 3. *S. Wightii*, Grev.—South Andaman, at South Corbyn's Cove. (K. 1690).

TURBINARIA, Bory.

1. *T. triquetra*, Y. Ag.—South Andaman, at South Corbyn's Cove, ejected from the sea. (K. 1694).—Nicobars.
 2. *T. condensata*, Sonder.—South Andaman, at South Corbyn's Cove, ejected from the sea. (K. 1962).

CARPACANTHUS, Kg.

1. *C. ilicifolius*, (Turner, vol. I, t. 51).—Andamans, Labyrinth Archipelago, near Termoklee Island, in deep sea.

VII.—*FLORIDEÆ.*

BATRACHOSPERMEÆ.

BATRACHOSPERMUM, Roth.

1. *B. Guianense*, Montg.—In the creeks above Watering Cove, South Andaman.—June. (K. 1658).
 2. *B. moniliforme*, Roth.—Pegu, Southern Yomah, in choungs near Kya-ëng. Decemb. (K. 1847).

DICTYOTÆ.

ZONARIA, Ag.

1. *Z. Fraseri*, Grev.—Frequent on rocks and sandstone banks

not only along the coast of South Andaman, (K. 1590), but also that of Arracan. (K. 1944).

CERAMIEÆ.

HORMOCERAS, Kg.

1. *H. flaccidum*, Harv.—Arracan, in crevices of marine sandstone rocks on Boronga Island. Octob. (K. 1941).

CORALLINEÆ.

AMPHIROA, Lx.

1. *A. Tribulus*, Lx.—Pegu, Diamond Island, thrown out from the sea (K. 1651).—Hitherto known only from St. Croix, Antilles.

2. *A. fragilissima*, Lx.—South Andaman, at Camping Bay (K. 1595).

JANIA, Lx.

1. *J. adhærens*, Lx.—South Andaman, coral reefs at Camping Bay.

2. *J. fastigiata*, Harvey.—South Andaman, at Camping Bay, (K. 1659) and at South Corbyn's Cove (K. 1653).

GALAXAUREÆ.

GALAXAURA, Lx.

1. *G. plicata*, Kg.—South Andaman. Frequent on coral reefs and often ejected from the sea along the beach (K. 1591).

2. *G. marginata*, Lx.—South Andaman, Ross Island (K. 1611).

3. *G. tomentosa*, Kg.—South Andaman, at Camping Bay (K. 1637).

4. *G. oblongata*, Lx.—South Andaman, Ross Island. (K. 1699).

GYMNOPHLEACEÆ.

HALYMENIA, Ag.

1. *H. tenuispina*, Kg. (Tab. Phyc. vol. xvii, t. 2, f. 1).—Andamans, Labyrinth Archipelago, Termoklee Island, ejected from the sea, parasitic on other sea-weeds. (K. 1695).

[NB. *Dumontia robusta*, β . *Wightii*, J. Ag. is found by Wichura, in Bay of Bengal, and most likely occurs also in the Burmese waters] S. K.

GIGARTINEÆ.

GRATELOUPIA, Ag.

1. *G. furcata*, Kg.—Arracan, marine sandstone banks of Boronga Island. Octob. (K. 1939).

GIGARTINA, Lx.

1. *G. spinosa*, Grev. (*Euchema spinosum*, Ag.; *Fucus lichenoides*, Willd., non L.).—Andamans, Termoklee Island. (K. 1696).—Edible.

CHONDROCOCCUS, Kg.

1. *Ch. spinulosus*, Kg.—South Andaman, Ross Island, in sea. (K. 1594).

CYSTOCLONEÆ.

HYPNEA, Lx.

1. *H. spinella*, J. Ag.—Pegu, Diamond Island (K. 1619); Arracan, frequent on marine sandstone banks.—(K. 1948—49).
2. *H. musciformis*, Lx.—Pegu, Diamond Island. (K. 1640).
3. *H. divaricata*, Grev.—Pegu, Diamond Island. (K. 1673).

GELIDIEÆ.

ACROCARPUS, Kg.

1. *A. intricatus*, Kg.—South Andaman, Camping Bay and Termoklee Island, on the roots and stems of mangrove trees, as far as they are submerged during high water. (K. 1608).
2. *A. pusillus*, Kg.—Arracan, Boronga Island, on marine sandstone banks. Octob. (K. 1951).

SPHÆROCOCCÆ.

SPHÆROCOCCUS, L.

1. *Sph. multipartitus*, ϵ . *lichenoides*, Ag.—(*Fucus æruginosus*, Turner, vol. III, t. 147, f.).—South Andaman, frequently ejected by the sea all along the coast.
2. *Sph. lichenoides*, L.—South Andaman, frequently ejected by the sea; Termoklee Island, (K. 1652).—Edible.
3. *Sph. Lemania*, Kg.—Arracan, on marine sandstone banks, frequent. Octob. (K. 1942).
4. *Sph. confervoides*, Ag.—Arracan, common on the rocky shores of Boronga Island. Octob. (K. 1943).
5. *Sph. dumosus*, Kg.—Arracan, marine sandstone banks of Boronga Island. Octob. (K. 1947).

TYLOCARPEÆ.

GYMNOGRONGUS, Mart.

1. *G. pygmæus*, Grev.—Arracan, on marine sandstone banks of Boronga Island. Octob. (K. 1950).

POLYSIPHONIEÆ.

POLYSIPHONIA, Grev.

1. *P. rufo-lanosa*, Harvey.—Arracan, Akyab, on grasses, &c., in brackish creeks of western coast. Decemb. (K. 1849).

LAURENCIEÆ.

LAURENCIA, Lx.

1. *L. obtusa*, Lx.—Arracan, on marine sandstone banks of Boronga Island. Octob. (K. 1946).

ACANTHOPHORA, Lx.

1. *A. Thierryi*, Lx.—Arracan, rare on the marine sandstone banks of Boronga Island. Octob. (K. 1954).

DELESSERIEÆ.

AGLAOPHYLLUM, Mont.

1. *A. multipartitum*, Kg.—South Andaman, Camping Bay. (K. 1589).

HYPOGLOSSUM, Kg.

1. *H. Vieillardii*, Kg.—Arracan, frequent on sandstone rocks and old branches, or on the submerged mangrove stems, not only in the tidal channels of Kolodyne-river, but also along the sea coast. Octob. (K. 1963).—Perhaps only a juvenile state of *H. Leprierrii*.

INDEX

TO

PART II, VOL. XL.

[NOTE.—The Index has been divided into four parts, 1. Names of Minerals, rocks, geographical places, &c. 2. Plants. 3. Invertebrate Animals. 4. Vertebrate Animals. Names of new genera and species have been marked with an (\*) asterisk.]

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*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.

| Date. | Mean Height of
the Barometer
at 32° Fahr. | Range of the Barometer
during the day. | | | Mean Dry Bulb
Thermometer. | Range of the Tempera-
ture during the day. | | |
|-------|---|---|---------|---------|-------------------------------|---|------|-------|
| | | Max. | Min. | Diff. | | Max. | Min. | Diff. |
| | Inches. | Inches. | Inches. | Inches. | o | o | o | o |
| 1 | 29.852 | 29.916 | 29.789 | 0.127 | 81.4 | 86.8 | 76.5 | 10.3 |
| 2 | .806 | .865 | .745 | .120 | 82.2 | 87.0 | 77.6 | 9.4 |
| 3 | .799 | .865 | .750 | .115 | 80.1 | 84.0 | 78.4 | 5.6 |
| 4 | .798 | .845 | .744 | .101 | 78.5 | 83.7 | 75.5 | 8.2 |
| 5 | .817 | .878 | .772 | .106 | 79.3 | 86.1 | 75.5 | 10.6 |
| 6 | .826 | .899 | .774 | .125 | 80.9 | 86.2 | 76.7 | 9.5 |
| 7 | .843 | .901 | .803 | .098 | 82.0 | 86.7 | 79.0 | 7.7 |
| 8 | .901 | .949 | .848 | .101 | 81.9 | 86.5 | 78.6 | 7.9 |
| 9 | .965 | 30.024 | .921 | .103 | 80.7 | 85.0 | 77.5 | 7.5 |
| 10 | .967 | .033 | .907 | .123 | 80.0 | 84.6 | 76.5 | 8.1 |
| 11 | .956 | .018 | .892 | .126 | 76.2 | 82.0 | 70.5 | 11.5 |
| 12 | .976 | .052 | .927 | .125 | 74.5 | 80.8 | 68.3 | 12.5 |
| 13 | .970 | .044 | .913 | .131 | 75.7 | 82.0 | 70.5 | 11.5 |
| 14 | .960 | .025 | .905 | .120 | 75.9 | 81.8 | 70.5 | 11.3 |
| 15 | .974 | .043 | .929 | .114 | 75.9 | 81.5 | 70.5 | 11.0 |
| 16 | .992 | .067 | .940 | .127 | 75.8 | 82.0 | 72.0 | 10.0 |
| 17 | 30.009 | .091 | .956 | .135 | 74.5 | 81.5 | 69.0 | 12.5 |
| 18 | 29.977 | .055 | .919 | .136 | 73.7 | 80.5 | 68.0 | 12.5 |
| 19 | 30.011 | .081 | .952 | .129 | 73.8 | 80.6 | 68.0 | 12.6 |
| 20 | .067 | .147 | 30.020 | .127 | 74.3 | 81.5 | 68.5 | 13.0 |
| 21 | .058 | .129 | .011 | .118 | 74.2 | 80.9 | 69.0 | 11.9 |
| 22 | 29.988 | .075 | 29.911 | .164 | 73.2 | 80.0 | 68.0 | 12.0 |
| 23 | .913 | 29.978 | .854 | .124 | 73.9 | 82.0 | 68.0 | 14.0 |
| 24 | 30.005 | 30.065 | .926 | .139 | 74.5 | 83.0 | 68.7 | 14.3 |
| 25 | .048 | .120 | .997 | .123 | 70.5 | 79.0 | 63.7 | 15.3 |
| 26 | .048 | .113 | 30.005 | .108 | 69.2 | 77.0 | 62.0 | 15.0 |
| 27 | .034 | .087 | 29.975 | .112 | 71.0 | 78.2 | 65.0 | 13.2 |
| 28 | .041 | .109 | .996 | .113 | 70.9 | 78.2 | 64.0 | 14.2 |
| 29 | .039 | .102 | .988 | .114 | 71.5 | 79.4 | 65.0 | 14.4 |
| 30 | .041 | .105 | .996 | .109 | 70.5 | 78.6 | 64.0 | 14.6 |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

Daily Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-
mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew
Point. | Mean Elastic force of
vapour. | Mean Weight of Vapour
in a Cubic foot of air. | Additional Weight of
Vapour required for
complete saturation. | Mean degree of Humi-
dity, complete satu-
ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--|---|---|
| | ° | ° | ° | ° | Inches. | T. gr. | T. gr. | |
| 1 | 77.2 | 4.2 | 74.3 | 7.1 | 0.835 | 8.99 | 2.28 | 0.80 |
| 2 | 78.0 | 4.2 | 75.1 | 7.1 | .857 | 9.21 | .33 | .80 |
| 3 | 77.8 | 2.3 | 76.2 | 3.9 | .887 | .58 | 1.26 | .88 |
| 4 | 76.4 | 2.1 | 74.9 | 3.6 | .851 | .21 | .14 | .89 |
| 5 | 77.3 | 2.0 | 75.9 | 3.4 | .879 | .51 | .08 | .90 |
| 6 | 78.2 | 2.7 | 76.3 | 4.6 | .890 | .59 | .51 | .86 |
| 7 | 78.0 | 4.0 | 75.2 | 6.8 | .860 | .24 | 2.23 | .81 |
| 8 | 78.2 | 3.7 | 75.6 | 6.3 | .871 | .37 | .07 | .82 |
| 9 | 78.0 | 2.7 | 76.1 | 4.6 | .885 | .53 | 1.51 | .86 |
| 10 | 76.8 | 3.2 | 74.6 | 5.4 | .843 | .11 | .70 | .84 |
| 11 | 69.8 | 6.4 | 65.3 | 10.9 | .623 | 6.78 | 2.88 | .70 |
| 12 | 68.5 | 6.0 | 64.3 | 10.2 | .603 | .59 | .59 | .72 |
| 13 | 70.6 | 5.1 | 67.0 | 8.7 | .659 | 7.17 | .34 | .75 |
| 14 | 70.7 | 5.2 | 67.1 | 8.8 | .661 | .19 | .38 | .75 |
| 15 | 70.6 | 5.3 | 66.9 | 9.0 | .657 | .15 | .42 | .75 |
| 16 | 69.5 | 6.3 | 65.1 | 10.7 | .619 | 6.74 | .80 | .71 |
| 17 | 68.7 | 5.8 | 64.6 | 9.9 | .609 | .64 | .54 | .72 |
| 18 | 67.6 | 6.1 | 63.3 | 10.4 | .584 | .38 | .58 | .71 |
| 19 | 68.0 | 5.8 | 63.9 | 9.9 | .595 | .50 | .48 | .72 |
| 20 | 69.3 | 5.0 | 65.8 | 8.5 | .634 | .91 | .21 | .76 |
| 21 | 68.5 | 5.7 | 64.5 | 9.7 | .607 | .62 | .47 | .73 |
| 22 | 67.9 | 5.3 | 63.7 | 9.5 | .591 | .46 | .36 | .73 |
| 23 | 68.3 | 5.6 | 64.4 | 9.5 | .605 | .61 | .40 | .73 |
| 24 | 68.3 | 6.2 | 64.0 | 10.5 | .597 | .50 | .68 | .71 |
| 25 | 62.8 | 7.7 | 56.6 | 13.9 | .467 | 5.13 | 3.00 | .63 |
| 26 | 63.4 | 5.8 | 58.8 | 10.4 | .503 | .54 | 2.27 | .71 |
| 27 | 65.7 | 5.3 | 61.5 | 9.5 | .550 | 6.04 | .21 | .73 |
| 28 | 66.1 | 4.8 | 62.3 | 8.6 | .565 | .20 | .03 | .75 |
| 29 | 66.6 | 4.9 | 62.7 | 8.8 | .572 | .27 | .11 | .75 |
| 30 | 64.6 | 5.9 | 59.9 | 10.6 | .521 | 5.72 | .41 | .70 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.

| Hour. | Mean Height of
the Barometer at
32° Fahr. | Range of the Barometer
for each hour during
the month. | | | Mean Dry Bulb
Thermometer. | Range of the Tempera-
ture for each hour
during the month. | | |
|----------------|---|--|---------|---------|-------------------------------|--|------|-------|
| | | Max. | Min. | Diff. | | Max. | Min. | Diff. |
| | Inches. | Inches. | Inches. | Inches. | ° | ° | ° | ° |
| Mid-
night. | 29.953 | 30.063 | 29.797 | 0.266 | 73.5 | 81.0 | 65.5 | 15.5 |
| 1 | .945 | .055 | .785 | .270 | 73.1 | 80.0 | 64.8 | 15.2 |
| 2 | .936 | .044 | .770 | .274 | 72.6 | 79.9 | 64.0 | 15.9 |
| 3 | .929 | .032 | .757 | .275 | 72.1 | 79.8 | 63.0 | 16.8 |
| 4 | .931 | .038 | .756 | .282 | 71.7 | 79.5 | 62.8 | 16.7 |
| 5 | .942 | .056 | .760 | .296 | 71.4 | 79.5 | 62.5 | 17.0 |
| 6 | .961 | .079 | .792 | .287 | 71.0 | 79.0 | 62.0 | 17.0 |
| 7 | .981 | .101 | .814 | .287 | 71.3 | 79.2 | 62.0 | 17.2 |
| 8 | 30.004 | .128 | .820 | .308 | 73.5 | 81.2 | 66.0 | 15.2 |
| 9 | .020 | .147 | .838 | .309 | 75.8 | 82.4 | 68.5 | 13.9 |
| 10 | .020 | .142 | .843 | .299 | 78.0 | 84.0 | 70.5 | 13.5 |
| 11 | .001 | .119 | .823 | .296 | 79.9 | 86.2 | 73.2 | 13.0 |
| Noon. | 29.973 | .087 | .804 | .283 | 80.8 | 86.5 | 75.0 | 11.5 |
| 1 | .943 | .061 | .775 | .286 | 81.4 | 86.8 | 76.0 | 10.8 |
| 2 | .923 | .038 | .753 | .285 | 81.6 | 87.0 | 77.0 | 10.0 |
| 3 | .910 | .029 | .744 | .285 | 81.4 | 86.3 | 77.0 | 9.3 |
| 4 | .907 | .020 | .747 | .273 | 80.5 | 86.0 | 76.0 | 10.0 |
| 5 | .918 | .031 | .762 | .269 | 79.6 | 85.6 | 75.0 | 10.6 |
| 6 | .928 | .046 | .773 | .273 | 77.6 | 84.0 | 72.5 | 11.5 |
| 7 | .947 | .060 | .787 | .273 | 76.4 | 83.0 | 70.5 | 12.5 |
| 8 | .962 | .067 | .804 | .263 | 75.6 | 82.4 | 69.0 | 13.4 |
| 9 | .970 | .077 | .809 | .268 | 74.8 | 82.5 | 68.0 | 14.5 |
| 10 | .973 | .080 | .809 | .271 | 74.1 | 82.0 | 66.8 | 15.2 |
| 11 | .968 | .075 | .798 | .277 | 73.6 | 81.5 | 66.5 | 15.0 |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.—(Continued.)

| Hour. | Mean Wet Bulb Ther-
mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew
Point. | Mean Elastic force of
Vapour. | Mean Weight of Vapour
in a Cubic foot of air. | Additional Weight of
Vapour required for
complete saturation. | Mean degree of Humi-
dity, complete satura-
tion being unity. |
|----------------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--|---|---|
| | ° | ° | ° | ° | Inches. | T. gr. | T. gr. | |
| Mid-
night. | 70.8 | 2.7 | 68.9 | 4.6 | 0.701 | 7.66 | 1.24 | 0.86 |
| 1 | 70.5 | 2.6 | 68.4 | 4.7 | .690 | .54 | .25 | .86 |
| 2 | 70.1 | 2.5 | 68.1 | 4.5 | .684 | .47 | .19 | .86 |
| 3 | 69.8 | 2.3 | 68.0 | 4.1 | .681 | .47 | .06 | .88 |
| 4 | 69.6 | 2.1 | 67.9 | 3.8 | .679 | .45 | 0.98 | .88 |
| 5 | 69.3 | 2.1 | 67.6 | 3.8 | .672 | .38 | .97 | .88 |
| 6 | 69.0 | 2.0 | 67.4 | 3.6 | .668 | .33 | .92 | .89 |
| 7 | 69.3 | 2.0 | 67.7 | 3.6 | .674 | .40 | .93 | .89 |
| 8 | 70.2 | 3.3 | 67.9 | 5.6 | .679 | .42 | 1.48 | .83 |
| 9 | 71.2 | 4.6 | 68.0 | 7.8 | .681 | .41 | 2.13 | .78 |
| 10 | 71.8 | 6.2 | 67.5 | 10.5 | .670 | .26 | .93 | .71 |
| 11 | 72.1 | 7.8 | 66.6 | 13.3 | .651 | .02 | 3.76 | .65 |
| | | | | | | | | |
| Noon. | 72.1 | 8.7 | 66.0 | 14.8 | .638 | 6.87 | 4.20 | .62 |
| 1 | 72.1 | 9.3 | 65.6 | 15.8 | .630 | .78 | .49 | .60 |
| 2 | 71.9 | 9.7 | 65.1 | 16.5 | .619 | .66 | .68 | .59 |
| 3 | 71.8 | 9.6 | 65.1 | 16.3 | .619 | .67 | .60 | .59 |
| 4 | 71.5 | 9.0 | 65.2 | 15.3 | .621 | .70 | .28 | .61 |
| 5 | 72.0 | 7.6 | 66.7 | 12.9 | .653 | 7.04 | 3.65 | .66 |
| 6 | 72.6 | 5.0 | 69.1 | 8.5 | .706 | .64 | 2.43 | .76 |
| 7 | 72.4 | 4.0 | 67.6 | 8.8 | .672 | .31 | .41 | .75 |
| 8 | 71.9 | 3.7 | 69.3 | 6.3 | .711 | .74 | 1.74 | .82 |
| 9 | 71.4 | 3.4 | 69.0 | 5.8 | .704 | .67 | .59 | .83 |
| 10 | 71.0 | 3.1 | 68.8 | 5.3 | .699 | .63 | .44 | .84 |
| 11 | 70.6 | 3.0 | 68.5 | 5.1 | .692 | .57 | .36 | .85 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.
Solar Radiation, Weather, &c.*

| Date. | Max. Solar radiation. | Rain Gauge 1½ ft. above Ground. | WIND. | | | General aspect of the Sky. |
|-------|-----------------------|---------------------------------|-----------------------|---------------|-----------------|--|
| | | | Prevailing direction. | Max. Pressure | Daily Velocity. | |
| | ° | Inches | [by W | lb | Miles | |
| 1 | 147.0 | ... | N E, E N E & N | ... | 79.0 | B to 9 A. M., ☿ to 5 P. M.,
☿ afterwards. |
| 2 | 140.0 | ... | N E. & N. | ... | 64.2 | B to 5 A. M., ☿ to 9 A. M.,
☿ & ☿ to 5 P. M. S after-
wards. L on S at 7 P. M. |
| 3 | 122.0 | 0.03 | NNE, ENE & SSE | ... | 87.4 | ☿ & ☿ to 5 A. M. O to 6 P.
M. S afterwards. Slight R at
10 A. M., 1, 2, & 3 P. M. |
| 4 | 111.0 | 1.22 | SE, E by N & ENE. | ... | 59.5 | Chiefly O. R at 12 A. M., &
from 5¼ to 7 P. M. |
| 5 | 143.4 | 0.41 | E N E. & S S W. | 1.2 | 60.9 | ☿ to 8 A. M., ☿ to 4 P. M.,
☿ to 7 P. M., B afterwards
T at 1½ P. M. Slightly foggy
at 9 & 10 P. M. R at 2 P. M.. |
| 6 | 145.2 | ... | S S W. & W. | ... | 16.6 | B to 7 A. M., ☿ afterwards.
Foggy from 2 to 7 A. M., L on
N at 6 P. M., T at 6¼ & 7 P. M.,
D at 1¾ & 4 P. M. |
| 7 | 145.5 | ... | W. & N E. | ... | 24.3 | Chiefly ☿. T at 4½ A. M. D
at 3 & 4½ A. M. |
| 8 | 137.8 | ... | E S E. & S E. | ... | 37.8 | ☿ to 12 A. M., ☿ to 4 P. M.
B afterwards. Slightly foggy
at 7 & 8 P. M., |
| 9 | 142.0 | ... | Variable. | ... | 44.2 | ☿ & ☿ D at 4½ P. M. |
| 10 | 142.0 | ... | N N W & variable | ... | 61.6 | ☿ to 4 P. M., B afterwards. |
| 11 | 142.7 | ... | N N E. & W by N. | ... | 125.5 | B to 12 A. M., ☿ to 5 P. M.
B afterwards. |
| 12 | 135.0 | ... | W by N & W N W. | ... | 34.7 | B. |
| 13 | 138.0 | ... | W N W. & N W. | ... | 77.3 | B to 10 A. M., ☿ to 4 P. M.,
B afterwards. |
| 14 | 138.5 | ... | N W. & E by N. | ... | 50.2 | B to 10 A. M., ☿ to 4 P. M.,
B afterwards. Slightly foggy
from 3 to 6 A. M., |
| 15 | 139.5 | ... | NE, ENE & N by W | ... | 58.2 | B to 5 A. M., ☿ to 5 P. M.,
B to 9 P. M., ☿ afterwards. |
| 16 | 142.3 | ... | N by W, N by E & W | ... | 32.7 | ☿ & ☿ to 6 A. M., ☿ to 4
P. M., B afterwards. |
| 17 | 140.8 | ... | W by N. & S W. | ... | 29.7 | B to 11 A. M., ☿ to 4 P. M.,
B afterwards. |
| 18 | 140.0 | ... | S W & S by W. | ... | 24.2 | B. |
| 19 | 145.0 | ... | S by W. & S W. | 0.2 | 69.0 | Chiefly B. Slightly foggy at
8 P. M. |
| 20 | 141.3 | ... | S W. | ... | 74.3 | B to 11 A. M., ☿ to 4 P. M.
B afterwards. |
| 21 | 135.6 | ... | SW, SSW & W by S | ... | 58.5 | B. Foggy at 9 & 10 P. M. |

☿ Cirri, —i Strati, ☿ Cumuli, ☿ Ciro-strati, ☿ Cumulo-strati, ☿ Nimbi,
☿ Cirro-cumuli, B clear, S straton, O overcast, T thunder, L lightning
R rain, D drizzle.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge 1½ ft. above Ground. | WIND. | | | General aspect of the Sky. |
|-------|-----------------------|---------------------------------|-----------------------|---------------|-----------------|---|
| | | | Prevailing direction. | Max. Pressure | Daily Velocity. | |
| | ° | Inches | [S W. | lb | Miles | |
| 22 | 135.4 | ... | S by W, S, WSW & | ... | 46.8 | B to 10 A. M., \i to 4 P. M.,
B afterwards. Slightly foggy
from 8 to 11 P. M. |
| 23 | 137.2 | ... | S W & S S W. | ... | 89.4 | B. |
| 24 | 138.5 | ... | SSW, SW & WNW | ... | 100.0 | Chiefly B. |
| 25 | 134.8 | ... | N W & N by E. | 0.2 | 165.1 | B. Foggy at 9 P. M. |
| 26 | 128.8 | ... | N by E & N by W. | ... | 144.5 | B. |
| 27 | 130.6 | ... | N by W. & N. | 0.4 | 145.8 | B to 10 A. M., \i to 2 P. M.
B afterwards. |
| 28 | 134.2 | ... | N by W. & N W. | ... | 80.0 | B to 11 A. M., \i to 4 P. M.
B afterwards. Slightly foggy
from 7 to 10 P. M. |
| 29 | 133.0 | ... | N W. & N. | ... | 64.7 | B. Foggy from 7 to 10 P. M. |
| 30 | 133.8 | ... | N. & N by W. | ... | 76.8 | B to 5 A. M., \i to 11 A. M.
B afterwards. Foggy from 7
to 11 P. M. |

\i Cirri, —i Strati, ^i Cumuli, \i Cirro-strati, ^i Cumulo-strati, \i Nimbi,
\i Cirro-cumuli, B clear, S strati, O overcast, T thunder, L lightning,
P rain, D drizzle

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of November 1870.*

MONTHLY RESULTS.

| | Inches. |
|---|---------|
| Mean height of the Barometer for the month... | 29.956 |
| Max. height of the Barometer occurred at 9 A. M. on the 20th. | 30.147 |
| Min. height of the Barometer occurred at 3 P. M. on the 4th. | 29.744 |
| Extreme range of the Barometer during the month | 0.403 |
| Mean of the daily Max. Pressures | 30.023 |
| Ditto ditto Min. ditto | 29.902 |
| Mean daily range of the Barometer during the month | 0.121 |

| | ° |
|---|------|
| Mean Dry Bulb Thermometer for the month | 75.9 |
| Max. Temperature occurred at 2 P. M. on the 2nd. | 87.0 |
| Min. Temperature occurred at 6 & 7 A. M. on the 26th. | 62.0 |
| Extreme range of the Temperature during the month | 25.0 |
| Mean of the daily Max. Temperature | 82.2 |
| Ditto ditto Min. ditto | 70.8 |
| Mean daily range of the Temperature during the month | 11.4 |

| | |
|---|------|
| Mean Wet Bulb Thermometer for the month | 71.0 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer | 4.9 |
| Computed Mean Dew-point for the month | 67.6 |
| Mean Dry Bulb Thermometer above computed mean Dew-point | 8.3 |

| | Inches. |
|--|---------|
| Mean Elastic force of Vapour for the month | 0.672 |

| | Troy grain. |
|--|-------------|
| Mean Weight of Vapour for the month | 7.32 |
| Additional Weight of Vapour required for complete saturation | 2.25 |
| Mean degree of humidity for the month, complete saturation being unity | 0.77 |

| | ° |
|---|-------|
| Mean Max. Solar radiation Thermometer for the month | 137.4 |

| | Inches. |
|--|--------------|
| Rained 6 days.—Max. fall of rain during 24 hours | 1.22 |
| Total amount of rain during the month | 1.66 |
| Total amount of rain indicated by the Gauge* attached to the anemometer during the month | 1.56 |
| Prevailing direction of the Wind... | S W & N by W |

\* Height 70 feet 10 inches above ground.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

Latitude 22° 33' 1" North. Longitude 88° 20' 34" East.

Height of the Cistern of the Standard Barometer above the sea level, 18.11 feet.

Daily Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.

| No. | Mean Height of
the Barometer
at 32° Fahr. | Range of the Barometer
during the day. | | | Mean Dry Bulb
Thermometer. | Range of the Tempera-
ture during the day. | | |
|-----|---|---|---------|---------|-------------------------------|---|------|-------|
| | | Max. | Min. | Diff. | | Max. | Min. | Diff. |
| | Inches. | Inches. | Inches. | Inches. | o | o | o | o |
| 1 | 30.058 | 30.135 | 30.011 | 0.124 | 69.5 | 79.0 | 61.5 | 17.5 |
| 2 | .065 | .132 | .009 | .123 | 69.0 | 78.5 | 61.2 | 17.3 |
| 3 | .094 | .164 | .039 | .125 | 68.1 | 78.0 | 60.4 | 17.6 |
| 4 | .086 | .149 | .025 | .124 | 67.6 | 77.3 | 60.2 | 17.1 |
| 5 | .078 | .144 | .017 | .127 | 66.2 | 74.4 | 60.0 | 14.4 |
| 6 | .059 | .126 | .009 | .117 | 65.8 | 74.7 | 58.2 | 16.5 |
| 7 | .082 | .150 | .039 | .111 | 67.1 | 76.6 | 60.2 | 16.4 |
| 8 | .083 | .152 | .038 | .114 | 66.4 | 75.8 | 58.5 | 17.3 |
| 9 | .076 | .157 | .024 | .133 | 65.6 | 74.6 | 57.8 | 16.8 |
| 10 | .066 | .121 | .020 | .101 | 65.8 | 75.5 | 58.6 | 16.9 |
| 11 | .051 | .125 | 29.979 | .146 | 65.4 | 74.5 | 75.6 | 16.9 |
| 12 | .022 | .102 | .964 | .138 | 64.5 | 72.8 | 57.5 | 15.3 |
| 13 | .032 | .091 | .988 | .103 | 66.0 | 74.9 | 58.5 | 16.4 |
| 14 | .083 | .152 | 30.038 | .114 | 65.4 | 75.2 | 57.6 | 17.6 |
| 15 | .100 | .184 | .045 | .139 | 66.4 | 75.5 | 58.5 | 17.0 |
| 16 | .057 | .136 | 29.986 | .150 | 67.1 | 75.8 | 60.6 | 15.2 |
| 17 | .018 | .104 | .958 | .146 | 65.9 | 75.0 | 58.6 | 16.4 |
| 18 | 29.994 | .068 | .927 | .141 | 64.8 | 73.5 | 75.5 | 16.0 |
| 19 | 30.008 | .095 | .940 | .155 | 63.9 | 72.4 | 57.2 | 15.2 |
| 20 | 29.929 | .010 | .851 | .159 | 64.2 | 73.4 | 57.0 | 16.4 |
| 21 | .850 | 29.919 | .789 | .130 | 66.1 | 75.8 | 58.0 | 17.8 |
| 22 | .930 | 30.019 | .846 | .173 | 67.1 | 77.0 | 59.0 | 18.0 |
| 23 | 30.043 | .126 | .991 | .135 | 66.4 | 75.5 | 59.0 | 16.5 |
| 24 | .058 | .137 | 30.015 | .122 | 66.7 | 75.3 | 60.5 | 14.8 |
| 25 | .029 | .118 | 29.956 | .162 | 65.8 | 74.0 | 59.1 | 14.9 |
| 26 | 29.983 | .063 | .929 | .134 | 66.1 | 74.5 | 59.4 | 15.1 |
| 27 | .982 | .952 | .932 | .120 | 65.7 | 74.6 | 58.0 | 16.6 |
| 28 | 30.018 | .108 | .969 | .139 | 66.2 | 75.9 | 58.5 | 17.4 |
| 29 | .004 | .078 | .939 | .139 | 67.0 | 77.2 | 59.6 | 17.6 |
| 30 | 29.961 | .025 | .900 | .125 | 68.2 | 77.8 | 60.8 | 17.0 |
| 31 | .916 | 29.997 | .852 | .145 | 70.2 | 80.1 | 62.8 | 17.3 |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived, from the hourly observations, made at the several hours during the day.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

Daily Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.—(Continued.)

| Date. | Mean Wet Bulb Ther-
mometer. | Dry Bulb above Wet. | Computed Dew Point. | Dry Bulb above Dew
Point. | Mean Elastic force of
vapour. | Mean Weight of Vapour
in a Cubic foot of air. | Additional Weight of
Vapour required for
complete saturation. | Mean degree of Humi-
dity, complete satu-
ration being unity. |
|-------|---------------------------------|---------------------|---------------------|------------------------------|----------------------------------|--|---|---|
| | o | o | o | o | Inches. | T. gr. | T. gr. | |
| 1 | 63.3 | 6.2 | 58.3 | 11.2 | 0.494 | 5.44 | 2.44 | 0.69 |
| 2 | 62.4 | 6.6 | 57.1 | 11.9 | .475 | .23 | .53 | .67 |
| 3 | 60.7 | 7.4 | 54.8 | 13.3 | .440 | 4.85 | .70 | .64 |
| 4 | 60.5 | 7.1 | 54.8 | 12.8 | .440 | .85 | .59 | .65 |
| 5 | 58.6 | 7.6 | 52.5 | 13.7 | .407 | .51 | .61 | .63 |
| 6 | 59.6 | 6.2 | 54.6 | 11.2 | .437 | .85 | .19 | .69 |
| 7 | 61.5 | 5.6 | 57.0 | 10.1 | .473 | 5.23 | .09 | .71 |
| 8 | 60.6 | 5.8 | 56.0 | 10.4 | .458 | .93 | .09 | .71 |
| 9 | 60.2 | 5.4 | 55.9 | 9.7 | .456 | .06 | 1.94 | .72 |
| 10 | 60.2 | 5.6 | 55.7 | 10.1 | .453 | .93 | 2.01 | .71 |
| 11 | 59.4 | 6.0 | 54.6 | 10.8 | .437 | 4.85 | .10 | .70 |
| 12 | 59.2 | 5.3 | 55.0 | 9.5 | .442 | .92 | 1.84 | .73 |
| 13 | 60.0 | 6.0 | 55.2 | 10.8 | .445 | .94 | 2.14 | .70 |
| 14 | 60.3 | 5.1 | 56.2 | 9.2 | .461 | 5.12 | 1.83 | .74 |
| 15 | 60.7 | 5.7 | 56.1 | 10.3 | .459 | .10 | 2.07 | .71 |
| 16 | 62.0 | 5.1 | 57.9 | 9.2 | .488 | .39 | 1.93 | .74 |
| 17 | 60.4 | 5.5 | 56.0 | 9.9 | .458 | .08 | .98 | .72 |
| 18 | 58.6 | 6.2 | 53.6 | 11.2 | .422 | 4.69 | 2.14 | .69 |
| 19 | 58.2 | 5.7 | 53.1 | 10.8 | .415 | .63 | .00 | .70 |
| 20 | 58.9 | 5.3 | 54.1 | 10.1 | .429 | .78 | 1.90 | .71 |
| 21 | 59.9 | 6.2 | 54.9 | 11.2 | .441 | .89 | 2.21 | .69 |
| 22 | 61.3 | 5.8 | 56.7 | 10.4 | .469 | 5.18 | .14 | .71 |
| 23 | 60.4 | 6.0 | 55.6 | 10.8 | .452 | .01 | .16 | .70 |
| 24 | 61.1 | 5.6 | 56.6 | 10.1 | .467 | .17 | .06 | .72 |
| 25 | 60.8 | 5.0 | 56.8 | 9.0 | .470 | .21 | 1.83 | .74 |
| 26 | 60.5 | 5.6 | 56.0 | 10.1 | .458 | .08 | 2.02 | .72 |
| 27 | 60.5 | 5.2 | 56.3 | 9.4 | .462 | .14 | 1.88 | .73 |
| 28 | 61.6 | 4.6 | 57.9 | 8.3 | .488 | .40 | .72 | .76 |
| 29 | 61.4 | 5.6 | 56.9 | 10.1 | .472 | .21 | 2.09 | .71 |
| 30 | 62.7 | 5.5 | 58.3 | 9.9 | .494 | .45 | .13 | .72 |
| 31 | 63.9 | 6.3 | 58.9 | 11.3 | .504 | 55. | .50 | .69 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.

| Hour. | Mean Height of
the Barometer at
32° Fahr. | Range of the Barometer
for each hour during
the month. | | | Mean Dry Bulb
Thermometer. | Range of the Tempera-
ture for each hour
during the month. | | |
|----------------|---|--|---------|---------|-------------------------------|--|------|-------|
| | | Max. | Min. | Diff. | | Max. | Min. | Diff. |
| | Inches. | Inches. | Inches. | Inches. | ° | ° | ° | ° |
| Mid-
night. | 30.029 | 30.108 | 29.864 | 0.244 | 62.8 | 66.0 | 60.2 | 5.8 |
| 1 | .021 | .095 | .858 | .237 | 62.1 | 65.2 | 59.5 | 5.7 |
| 2 | .013 | .088 | .855 | .233 | 61.5 | 65.0 | 59.0 | 6.0 |
| 3 | .006 | .081 | .848 | .233 | 60.9 | 64.0 | 59.0 | 5.0 |
| 4 | .001 | .074 | .823 | .251 | 60.3 | 64.0 | 58.3 | 5.7 |
| 5 | .011 | .091 | .834 | .257 | 59.8 | 63.5 | 57.4 | 6.1 |
| 6 | .026 | .106 | .842 | .264 | 59.3 | 62.8 | 57.0 | 5.8 |
| 7 | .050 | .124 | .853 | .271 | 59.2 | 63.0 | 57.0 | 6.0 |
| 8 | .075 | .164 | .884 | .280 | 61.7 | 65.0 | 58.5 | 6.5 |
| 9 | .096 | .181 | .906 | .275 | 64.8 | 69.4 | 60.8 | 8.6 |
| 10 | .099 | .184 | .919 | .265 | 68.5 | 73.2 | 64.0 | 9.2 |
| 11 | .081 | .170 | .894 | .276 | 71.3 | 75.5 | 66.7 | 8.8 |
| Noon. | .050 | .136 | .859 | .277 | 73.1 | 77.1 | 69.0 | 8.1 |
| 1 | .015 | .100 | .825 | .275 | 74.5 | 78.5 | 69.8 | 8.7 |
| 2 | 29.992 | .063 | .803 | .260 | 75.4 | 79.5 | 71.6 | 7.9 |
| 3 | .978 | .051 | .789 | .262 | 75.5 | 80.1 | 72.4 | 7.7 |
| 4 | .973 | .048 | .790 | .258 | 74.2 | 79.5 | 70.7 | 8.8 |
| 5 | .979 | .057 | .796 | .261 | 72.7 | 78.0 | 69.7 | 8.3 |
| 6 | .989 | .062 | .807 | .255 | 69.8 | 74.0 | 67.4 | 6.6 |
| 7 | 30.008 | .088 | .829 | .259 | 67.8 | 71.5 | 65.8 | 5.7 |
| 8 | .025 | .100 | .845 | .255 | 66.5 | 70.5 | 64.5 | 6.0 |
| 9 | .037 | .110 | .869 | .241 | 65.3 | 69.2 | 63.0 | 6.2 |
| 10 | .040 | .120 | .876 | .244 | 64.3 | 68.0 | 62.0 | 6.0 |
| 11 | .034 | .119 | .867 | .252 | 63.5 | 66.5 | 61.2 | 5.3 |

The Mean Height of the Barometer, as likewise the Dry and Wet Bulb Thermometer Means are derived from the observations made at the several hours during the month.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

Hourly Means, &c. of the Observations and of the Hygrometrical elements
dependent thereon.—(Continued.)

| Hour. | Mean Wet Bulb Ther-
mometer. | Dry Bulb ab-
solute. | Computed Dew Point. | Dry Bulb above Dew
Point. | Mean Elastic force of
Vapour. | Mean Weight of Vapour
in a Cubic foot of air. | Additional Weight of
Vapour required for
complete saturation. | Mean degree of Humi-
dity, complete satura-
tion being unity. |
|----------------|---------------------------------|-------------------------|---------------------|------------------------------|----------------------------------|--|---|---|
| | ° | ° | ° | ° | Inches. | T. gr. | T. gr. | |
| Mid-
night. | 59.7 | 3.1 | 56.9 | 5.9 | 0.472 | 5.26 | 1.15 | 0.82 |
| 1 | 59.0 | 3.1 | 56.2 | 5.9 | .461 | .15 | .12 | .82 |
| 2 | 58.5 | 3.0 | 55.8 | 5.7 | .455 | .09 | .07 | .83 |
| 3 | 58.1 | 2.8 | 55.6 | 5.3 | .452 | .07 | 0.97 | .84 |
| 4 | 57.5 | 2.8 | 55.0 | 5.3 | .442 | 4.97 | .96 | .84 |
| 5 | 57.1 | 2.7 | 54.7 | 5.1 | .438 | .92 | .91 | .84 |
| 6 | 56.7 | 2.6 | 54.4 | 4.9 | .434 | .87 | .87 | .85 |
| 7 | 56.7 | 2.5 | 54.4 | 4.8 | .434 | .87 | 0.86 | .85 |
| 8 | 58.1 | 3.6 | 54.9 | 6.8 | .441 | .93 | 1.26 | .80 |
| 9 | 59.7 | 5.1 | 55.6 | 9.2 | .452 | 5.03 | .80 | .74 |
| 10 | 61.5 | 7.0 | 55.9 | 12.6 | .456 | .03 | 2.62 | .66 |
| 11 | 62.5 | 8.8 | 55.5 | 15.8 | .450 | 4.94 | 3.39 | .59 |
| Noon. | 62.7 | 10.4 | 54.4 | 18.7 | .434 | .73 | 4.06 | .54 |
| 1 | 63.2 | 11.3 | 55.3 | 19.2 | .447 | .88 | .30 | .53 |
| 2 | 63.6 | 11.8 | 55.3 | 20.1 | .447 | .87 | .56 | .52 |
| 3 | 63.4 | 12.1 | 54.9 | 20.6 | .441 | .79 | .67 | .51 |
| 4 | 63.0 | 11.2 | 55.2 | 19.0 | .445 | .86 | .23 | .54 |
| 5 | 63.4 | 9.3 | 56.0 | 16.7 | .458 | 5.00 | 3.68 | .58 |
| 6 | 63.5 | 6.3 | 58.5 | 11.3 | .498 | .48 | 2.47 | .69 |
| 7 | 62.8 | 5.0 | 58.8 | 9.0 | .503 | .55 | 1.93 | .74 |
| 8 | 62.1 | 4.4 | 58.6 | 7.9 | .499 | .53 | .66 | .77 |
| 9 | 61.3 | 4.0 | 58.1 | 7.2 | .491 | .45 | .48 | .79 |
| 10 | 60.7 | 3.6 | 57.5 | 6.8 | .481 | .35 | .37 | .80 |
| 11 | 60.1 | 3.4 | 57.0 | 6.5 | .473 | .27 | .28 | .81 |

All the Hygrometrical elements are computed by the Greenwich Constants.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

Solar Radiation, Weather, &c.

| Date. | Max. Solar radiation. | Rain Gauge
1½ ft. above
Ground. | WIND. | | | General aspect of the Sky. |
|-------|-----------------------|---------------------------------------|-----------------------|----------------|-----------------|---|
| | | | Prevailing direction. | Max. Pressure. | Daily Velocity. | |
| | ° | Inches | | lb | Miles | |
| 1 | 132.0 | ... | N by W & N by E | ... | 89.1 | B. Foggy at midnight and from 7 to 11 P. M. |
| 2 | 132.0 | ... | N N E & N by W | ... | 63.3 | B. Slightly foggy at midnight & 1 A. M., & from 7 to 11 P. M. |
| 3 | 133.5 | ... | N by W, NNW & N | ... | 120.5 | B. Slightly foggy from 8 to 11 P. M. |
| 4 | 133.5 | ... | N & N by E. | ... | 163.5 | B. Slightly foggy from 8 to 11 P. M. |
| 5 | 132.8 | ... | N & W by N. [W | ... | 116.4 | B. Slightly foggy from 8 to 11 P. M. |
| 6 | 130.0 | ... | WNW, W by N & | ... | 115.0 | B. Slightly foggy from 8 to 11 P. M. |
| 7 | 132.0 | ... | W & W N W. | ... | 99.3 | Chiefly B. Slightly foggy at 11 P. M. |
| 8 | 130.5 | ... | WNW & W by N. | ... | 73.0 | B. Slightly foggy from midnight to 4 A. M., & 7 to 11 P. M. |
| 9 | 131.5 | ... | W & W by N. | ... | 82.3 | B to 9 A. M., & 1 to 3 P. M. B afterwards. Slightly foggy from midnight to 8 A. M., & 7 to 9 P. M., & at 11 P. M. |
| 10 | 130.8 | ... | W by N & W | ... | 64.2 | B. Foggy from midnight to 2 A. M. |
| 11 | 130.0 | ... | W. | ... | 65.0 | B to 7 A. M., & 1 to 6 P. M., B afterwards. Slightly foggy from 8 to 11 P. M. |
| 12 | 134.0 | ... | W & W by N. | ... | 95.5 | B to 4 A. M., & 1 to 6 P. M., B afterwards. |
| 13 | 128.0 | ... | W by N. | ... | 106.8 | B. Slightly foggy from 8 to 11 P. M. |
| 14 | 129.2 | ... | W & W N W. | ... | 83.6 | B to 6 A. M., & 1 to 5 P. M., B afterwards. Slightly foggy at midnight & 1 A. M., & at 6 P. M. |
| 15 | 128.0 | ... | W N W & NW. | ... | 126.9 | B to 6 A. M., & 1 to 5 P. M., B afterwards. |
| 16 | 129.5 | ... | N by E & N E. | ... | 97.3 | B. |
| 17 | 128.5 | ... | N by E. | ... | 166.4 | B. |
| 18 | 129.4 | ... | N by E & WNW. | ... | 99.3 | B. |
| 19 | 126.7 | ... | WNW & NNE. | ... | 134.1 | B. |
| 20 | 127.8 | ... | NNE & W by N. | ... | 115.2 | B. Slightly foggy from 7 to 11 P. M. |
| 21 | 132.0 | ... | WSW & W by S. | ... | 104.2 | B to 10 A. M., & 1 to 4 P. M. B afterwards. Slightly foggy at 5 & 6 A. M. |
| 22 | 129.0 | ... | W by S & N W. | ... | 80.2 | B. Slightly foggy at 6 & 7 P. M. |
| 23 | 129.5 | ... | N W & N by E. | ... | 121.4 | B. |
| 24 | 127.0 | ... | N by E & N NE. | ... | 205.4 | B. |

\i Cirri, —i Strati, \i Cumuli, \i Ciro-strati, \i Cumulo-strati, \i Nimbi,
 \i Cirro-cumuli, B clear, S straton, O overcast, T thunder, L lightning
 R rain, D drizzle.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.
Solar Radiation, Weather, &c.*

| Date. | Max. Solar radiation. | Rain Gauge
1½ ft. above
Ground. | WIND. | | | General aspect of the Sky. |
|-------|-----------------------|---------------------------------------|-----------------------|----------------|-----------------|---|
| | | | Prevailing direction. | Max. Pressure. | Daily Velocity. | |
| | ° | Inches | | lb | Miles | |
| 25 | 130.0 | ... | N N E & N. | ... | 126.0 | B to 11 A. M., ½ to 5 P. M.,
B afterwards. |
| 26 | 129.4 | ... | N, N by E & W N W | ... | 131.2 | B to 6 A. M., ½ to 7 P. M.,
B afterwards. |
| 27 | 126.8 | ... | W N W | ... | 87.7 | B. Foggy at 11 P. M. |
| 28 | 128.0 | ... | W N W | ... | 79.0 | B. Slightly foggy from mid-
night to 3 & at 7 A. M., &
from 7 to 11 P. M. |
| 29 | 130.8 | ... | W N W. | ... | 75.8 | B. Foggy from midnight to
7 A. M. & 7 to 11 P. M. |
| 30 | 130.0 | ... | W N W. | ... | 88.6 | B to 3 A. M., ½ to 10 A. M.,
½ afterwards. Foggy from
midnight to 2 & at 6 A. M., &
from 7 to 11 P. M. |
| 31 | 134.8 | ... | W & W N W. | | 121.7 | Chiefly B. Slightly from 7
to 11 P. M. |

½ Cirri,—i Strati, ½ Cumuli, ½ Cirro-strati, ½ Cumulo-strati, ½ Nimbi,
½ Cirro-cumuli, B clear, S straton, O overcast, T thunder, L lightning,
R rain, D drizzle.

*Abstract of the Results of the Hourly Meteorological Observations
taken at the Surveyor General's Office, Calcutta,
in the month of December 1870.*

MONTHLY RESULTS.

| | Inches. |
|--|---------|
| Mean height of the Barometer for the month... | 30.026 |
| Max. height of the Barometer occurred at 10 A. M. on the 15th. | 30.184 |
| Min. height of the Barometer occurred at 3 P. M. on the 21st. | 29.789 |
| Extreme range of the Barometer during the month | 0.395 |
| Mean of the daily Max. Pressures | 30.101 |
| Ditto ditto Min. ditto | 29.969 |
| Mean daily range of the Barometer during the month | 0.132 |

| | ° |
|---|------|
| Mean Dry Bulb Thermometer for the month | 66.5 |
| Max. Temperature occurred at 3 P. M. on the 31st. | 80.1 |
| Min. Temperature occurred at 6 & 7 A. M. on the 20th. | 57.0 |
| Extreme range of the Temperature during the month | 23.1 |
| Mean of the daily Max. Temperature | 75.6 |
| Ditto ditto Min. ditto | 59.1 |
| Mean daily range of the Temperature during the month | 16.5 |

| | |
|---|------|
| Mean Wet Bulb Thermometer for the month | 60.6 |
| Mean Dry Bulb Thermometer above Mean Wet Bulb Thermometer | 5.9 |
| Computed Mean Dew-point for the month | 55.9 |
| Mean Dry Bulb Thermometer above computed mean Dew-point | 10.6 |

| | Inches. |
|--|---------|
| Mean Elastic force of Vapour for the month | 0.456 |

| | Troy grain. |
|--|-------------|
| Mean Weight of Vapour for the month | 5.05 |
| Additional Weight of Vapour required for complete saturation | 2.14 |
| Mean degree of humidity for the month, complete saturation being unity | 0.70 |

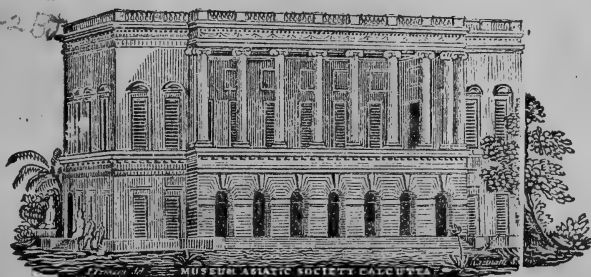
| | ° |
|---|-------|
| Mean Max. Solar radiation Thermometer for the month | 130.2 |

| | Inches. |
|--|--------------------|
| Rained No day,—Max. fall of rain during 24 hours | Nil. |
| Total amount of rain during the month | Nil. |
| Total amount of rain indicated by the Gauge* attached to the anemometer during the month | Nil. |
| Prevailing direction of the Wind | W N W, W by N & W. |

\* Height 70 feet 10 inches above ground.

JOURNAL
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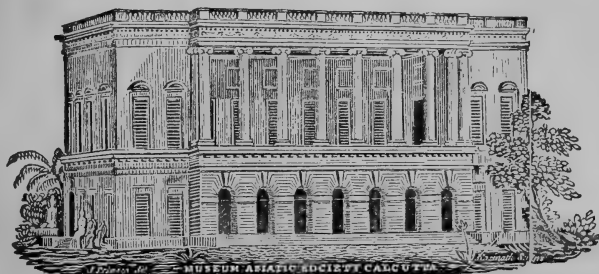
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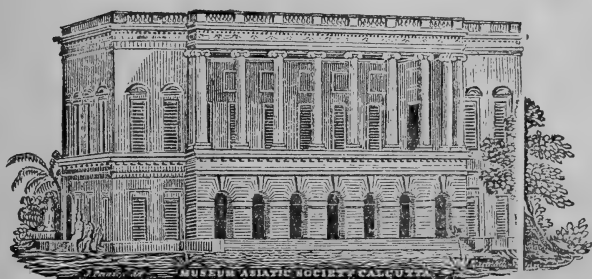
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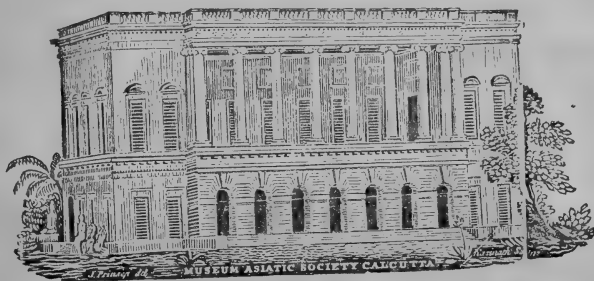
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